EXABYTE

MAGNUM 1X7 LTO AUTOLOADER

SCSI REFERENCE

1012975 C

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PART NUMBER 1012975 C

REVISION HISTORY

Revision	Date	Description
A	January 2005	Initial release.
B	March 2005	Updated to add LTO-3 information.
C	September 2005	Minor corrections and updates.

NOTE: The most current information about this product is available at Exabyte's web site (www.exabyte.com).

PRODUCT WARRANTY CAUTION The Magnum 1x7 LTO Autoloader by Exabyte® Corporation is warranted to be free from defects in materials, parts, and workmanship and will conform to the current product specification upon delivery. For the specific details of your warranty, refer to your sales contract or contact the company from which the autoloader was purchased.

The warranty for the autoloader shall not apply to failures caused by:

- Physical abuse or use not consistent with the operating instructions or product specifications.
- Repair or modification by any one other than Exabyte's personnel or agent in a manner differing from the maintenance instructions provided by Exabyte.
- Removal of the Exabyte identification label(s).
- Physical abuse due to improper packaging of returned autoloader.

If problems with the autoloader occur, contact your maintenance organization; do not void the product warranty by allowing untrained or unauthorized personnel to attempt repairs.

Caution Returning the autoloader in unauthorized packaging may damage the unit and void the warranty. If you are returning the autoloader for repair, package it in its original packaging (or in replacement packaging obtained from your vendor.)

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Exabyte Technical Support	www.exabyte.com/products/hardwarewarranty.cfm
To order supplies and accessories	
Exabyte Sales Support	1-800-774-7172
	1-800-392-8273 (Exabyte Media)
To return equipment for service (RMA Request)	
Exabyte Service	www.exabyte.com/company/about/contact.cfm

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ABOUT THIS MANUAL

This manual provides reference information for developing SCSI applications for the Magnum 1x7 LTO Autoloader (referred to as the *autoloader*). Note that SCSI operations performed by the autoloader are separate from the SCSI operations performed by the enclosed tape drive. For SCSI operations as they relate to the tape drive, refer to the tape drive documentation.

CONTENTS OF THIS MANUAL

This manual contains the following information:

- Chapter 1 provides a general overview of the autoloader.
- Chapter 2 contains information about how the autoloader operates as a device in a SCSI environment, including an overview of the control modes and common SCSI operations. This chapter also describes the elements in the autoloader, SCSI bus phases, SCSI messages, the SCSI command set, and common SCSI operations.
- Chapter 3 contains information about using SCSI commands to configure the autoloader and implementing common SCSI operations. This chapter also describes how the autoloader tracks data cartridges.
- Chapter 4 through Chapter 25 contain information about individual SCSI commands. For ease of reference, the commands are listed in alphabetical order.
- Appendix A provides reference information for autoloader errors.

RELATED PUBLICATIONS

For additional information about the autoloader and tape drive, refer to the following publications.

Magnum 1x7 LTO Autoloader

- *Magnum 1x7 LTO Autoloader Product Manual*, 1012581
- *Magnum 1x7 LTO Autoloader Quick Start Guide*, 1012583
- *Installing a Magnum 1x7 LTO Autoloader into a Rack*, 1012585
- *Replacing the Tape Drive in the Magnum 1x7 LTO Autoloader*, 1012586
- *Exabyte Bar Code Label Specification for LTO Ultrium Cartridges*, 1004080-000

IBM T400/T800 Ultrium Tape Drives

See the IBM web site at www.storage.ibm.com/tape/lto/oem/index.html to locate documentation and support information for the IBM LTO Ultrium tape drive.

Standards

- *Small Computer System Interface - 2 (SCSI-2)*, INCITS 131-1994[R2004]
- *SCSI Primary Commands-2 (SPC-2)*, INCITS 351-2001
- *SCSI-3 Primary Commands (SPC)*, INCITS 301-1997 [R2002]
- *SCSI-3 Medium Changer Commands (SMC)*, INCITS 314-1998 [R2003]
- *SCSI Parallel Interface-2 (SPI-2)*, INCITS 302-1998 [R2003]
- *TapeAlert Specification*, NCITS T10/02-142R0, Version 3.0, March 2002
- IEC 60297 Rack Standards

CONVENTIONS USED IN THIS MANUAL

This manual uses the following conventions:

Note: Notes provide additional information or suggestions about the topic or procedure being discussed.

! Important Read text marked by the "Important" icon for information that will help you complete a procedure or avoid extra steps.

Caution Read text marked by the "CAUTION" icon for information you must know to avoid damaging the autoloader, the tape drive, or losing data.

Warning Read text marked by the "WARNING" icon for information you must know to avoid personal injury.

1 PRODUCT OVERVIEW

This chapter provides an overview of the physical properties and features of the Magnum 1x7 LTO Autoloader, including the following:

- Features
- Control modes
- Emulation modes

1.1 FEATURES

Figure 1-1 shows the autoloader's front panel components. For a detailed description of these components, refer to the *Magnum 1x7 LTO Autoloader Product Manual*.

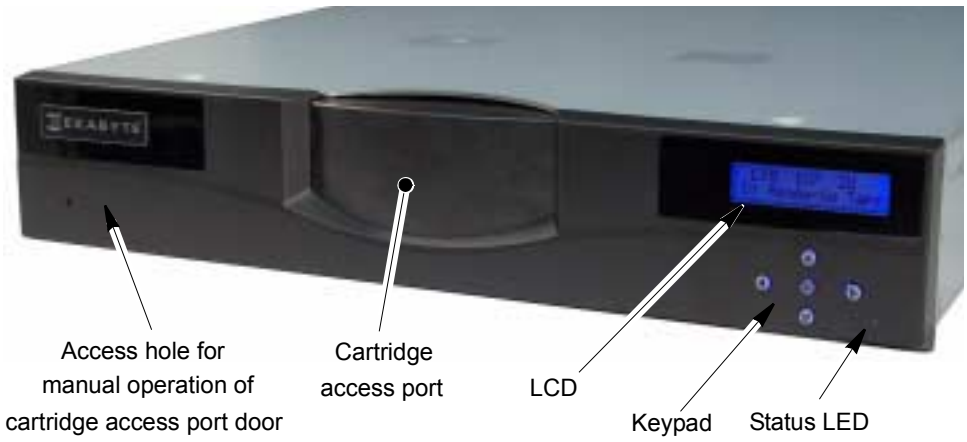

Figure 1-1 *Front panel components*

Figure 1-2 shows the back panel components of the autoloader.

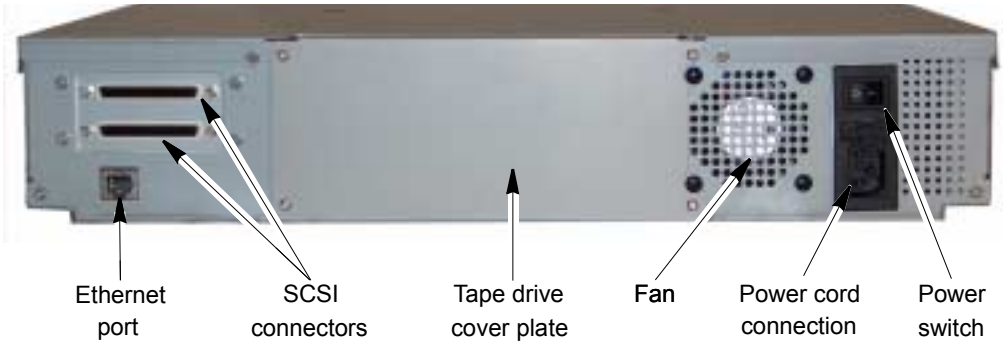

Figure 1-2 *Back panel components*

The Exabyte Magnum 1x7 LTO Autoloader includes the following features:

- **Storage for up to seven data cartridges.** Up to seven data cartridges are stored in the autoloader in cells mounted on a rotating cartridge carousel. The carousel automatically positions the cartridges at the tape drive or at the cartridge access port for removal. Cartridges can be removed from the autoloader with the power on or off.

  To provide software compatibility, a menu option allows you to configure the autoloader so that it uses and reports fewer cells than are physically present. This option can be advantageous with software applications that base licensing on the number of cells being used rather than the actual number of installed cells.

- **One LTO Ultrium Tape Drive.** The autoloader contains one high-performance, high-capacity LTO Ultrium 2 (LTO-2) or Ultrium 3 (LTO-3)tape drive.

- **Cartridge access port.** A cartridge access port, located on the front of the autoloader, allows easy insertion and removal of cartridges.

- **Cartridge loader.** The cartridge loader automatically moves data cartridges between the enclosed cartridge cells and the tape drive.

- **Bar code scanner.** A bar code scanner allows the autoloader to maintain an inventory of its cartridges.

- **Operator panel with LCD display.** The operator panel allows you to monitor autoloader operations and select configuration options.

- **Wide, low-voltage differential (LVD) SCSI interface.** The autoloader is available with a wide LVD SCSI interface.

- **Ethernet port for connection to a 10/100BaseT Ethernet network.** When used with the Remote Management utility, you can connect the autoloader to an Ethernet network for remote monitoring, upgrading autoloader microcode, and creating diagnostic listings.

- **Remote Management Utility.** The autoloader's Remote Management utility allows you to use a standard web browser to set configuration options, view autoloader information, and monitor autoloader operations over an Ethernet network.

- **Rack-mount hardware.** The autoloader is designed to mount in a standard 19-inch rack using just 2 units (2U) of rack space. Rack-mounting hardware is provided with the autoloader.

1.2 CONTROL MODES

Note: You can issue SCSI commands to the autoloader in any of the control modes. However, the autoloader must be in Random mode if you want to control autoloader through an application.

The operating mode determines how the autoloader processes cartridges. There are two operating modes:

- **Random mode**, in which the autoloader processes cartridges according to commands issued by an application using the SCSI command set.

- **Sequential mode**, in which autoloader processes the cartridges in Sequential order whenever they are unloaded from the tape drive. When once cartridge is unloaded, the autoloader advances to the next occupied cell and loads the cartridge into the tape drive. No autoloader application is required. You can use Sequential mode to operate the autoloader as a "stacker" if your application software does not provide direct support for the autoloader. See the *Magnum 1x7 LTO Autoloader Product Manual* for detailed information about Sequential mode.

The *Magnum 1x7 LTO Autoloader Product Manual* provides instructions for using the operator panel to switch between these control modes.

1.3 EMULATION MODES

Emulation allows the autoloader to be controlled by most, but not all, SCSI drivers developed for the device being emulated. Table 1-1 lists the INQUIRY command Product Identification string returned by the autoloader for each emulation mode setting. See page 6-6 for more information about the Product Identification string.

Table 1-1 *Product Identification string returned by the autoloader when using an emulation mode*

When you select this emulation mode...	The autoloader returns this Product Identification string in response to an INQUIRY command...
Native	The Product Identification stored in the autoloader's microcode. The default is "LTO_1x7_2U_ _ _ _ _ _ _" where each "_" represents an ASCII space character.
VXA AutoPak 1x10	"VXA_AutoPak_1x10" where each "_" represents an ASCII space character.
EZ17 Autoloader	"Exabyte EZ17_ _ _ _" where each "_" represents an ASCII space character.
210 Emulation	"EXB-210_ _ _ _ _ _ _ _ _" where each "_" represents an ASCII space character.

2

Overview of the Autoloader as a SCSI Device

This chapter provides background information for understanding how the Magnum 1x7 LTO Autoloader operates as a device on a SCSI bus. It provides an overview of the following:

- The autoloader's relationship to the SCSI bus
- The elements and element addresses of the autoloader
- SCSI bus communication, including bus phases, messages, commands, and statuses

2.1 Relationship to the SCSI Bus

The Small Computer System Interface (SCSI) is a standard that enables a host computer and peripheral equipment, such as the autoloader and its tape drive, to communicate. The autoloader and the tape drive each include independent SCSI controllers.

The physical components of the SCSI system consist of the following:

- **Initiator.** A computer equipped with a SCSI bus adapter card which allows it to send commands, messages, and data across the SCSI bus to targets such as the autoloader or its internal tape drive. The initiator can also receive data, messages, and status from the targets.
- **Targets.** Devices capable of receiving commands from an initiator. The autoloader and its internal tape drive are independent targets. The autoloader is the target for cartridge inventory and movement operations. The tape drive is the target for read and write operations.
- **SCSI bus.** The SCSI cables that connect the SCSI bus adapter card to the autoloader, tape drive, and other devices form the SCSI bus and provide a pathway for passing information between the initiator and the targets. The autoloader uses a wide, low-voltage differential (LVD) SCSI configuration. The SCSI bus attached to the autoloader must be terminated at both ends.

Each device attached to a SCSI bus has a unique SCSI ID that identifies it during communication. In wide SCSI configurations, up to 16 devices (including one or more initiators) can be attached to each SCSI bus. SCSI IDs can range from 0 to 15 for each bus.

! Important Although single-ended SCSI is compatible with Ultra-2 and Ultra-3 SCSI, Exabyte does not support single-ended devices on the SCSI bus used by the autoloader.

Attaching an HVD device to an LVD SCSI bus may cause the SCSI bus to hang.

2.2 ELEMENTS AND ELEMENT ADDRESSES

When you issue SCSI commands to the autoloader, you may need to specify an *element address* to identify a specific location (called an *element*). The autoloader contains the following types of elements:

- **Medium transport element.** The carousel and cartridge loader comprise the medium transport element. Together they move the cartridges in the autoloader.
- **Storage elements.** The cartridge cells in the autoloader are the storage elements that store the cartridges while they are not being used in the tape drive.
- **Data transfer element.** The tape drive is a data transfer element that reads and writes data. The tape drive has its own SCSI ID and responds to tape drive-specific SCSI commands.

Each of the elements in the autoloader has a default element address, as shown in Figure 2-1. Chapter 3 provides explanations of how you use the element addresses and how you can change them.

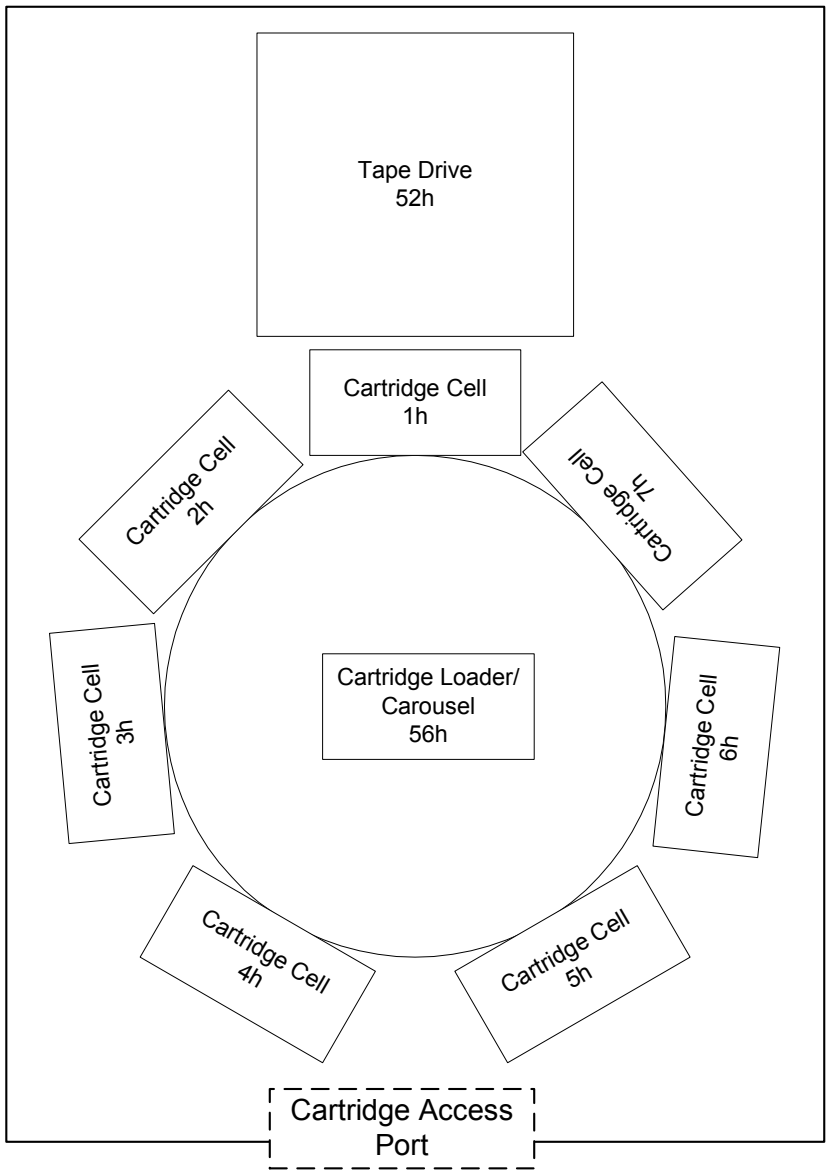

Figure 2-1 *Default element addresses*

2.3 COMMUNICATION ACROSS THE SCSI BUS

This section explains how communication across the SCSI bus is implemented. It discusses the SCSI bus phases and messages supported by the autoloader.

2.3.1 SCSI BUS PHASES

Bus phases determine the direction and type of information transferred across the data lines of the SCSI bus. The possible bus phases include Bus Free, Arbitration, Selection, Reselection, and Transfer (which includes four subsets: Message In or Message Out, Command Out, Data In or Data Out, and Status In). Table 2-1 describes the bus phases.

Table 2-1 *SCSI bus phases and information transfer phases*

Bus Phase	Description
Bus Free	The Bus Free phase specifies that no device is using the bus.
Arbitration	The Arbitration phase allows devices to compete for access on the bus.
Selection	The Selection phase allows an initiator to select the autoloader for communication.
Reselection	The Reselection phase allows the autoloader to reconnect to the initiator after it disconnects.
Transfer: ▪ Message In/ Message Out ▪ Command Out ▪ Data In/ Data Out ▪ Status In	The Message phases help manage the physical path between the initiators and targets. ▪ In the Message In phase, the autoloader sends a message to the initiator. In the Message Out phase, the initiator sends a message to the autoloader. ▪ In the Command Out phase, the initiator sends a command to the autoloader. Commands contain information about what actions the autoloader should perform. ▪ In the Data In phase, the autoloader transfers data to the initiator. In the Data Out phase, the initiator transfers data to the autoloader. ▪ In the Status In phase, the autoloader returns a status byte to the initiator. The status byte indicates the results of the command's execution.

2.3.2 SCSI MESSAGES

The SCSI message system allows communication between an initiator and the autoloader for physical path management. Messages allow the initiator and the autoloader to manage error detection, data transfer retries, and the data path. The autoloader supports the SCSI messages listed in Table 2-2.

Notes:

- One or more messages can be sent during a single message phase.
- The messages supported by the autoloader are independent of the messages supported by the tape drive. For information about the messages for the tape drive, refer to the documentation for the tape drive.

Table 2-2 *SCSI messages supported by the autoloader*

Message	Hex Value	Description
Task Complete	00h	The autoloader informs the initiator that the execution of the command was completed and that it sent a valid status byte to the initiator.
Extended Messages	01h	**Synchronous Data Transfer Request (01h)** The autoloader supports synchronous data transfer.
		Wide Data Transfer Request (03h) The autoloader supports wide data transfer.
Save Data Pointers	02h	The autoloader requests that the initiator copy the current data pointer for possible use by the Restore Pointers message during error recovery.
Restore Pointers	03h	The autoloader informs the initiator that it did not properly receive a block of data or the command descriptor block (CDB) and that the data needs to be transferred again.
Disconnect	04h	The autoloader informs the initiator that it plans to disconnect from the SCSI bus and that a reconnect will be required later.
Initiator Detected Error	05h	The initiator informs the autoloader that an error occurred. The autoloader can retry the operation.
Abort Task Set	06h	The initiator is clearing the present and any pending operation for that initiator. When the autoloader accepts this message, it releases the bus into the Bus Free phase.
Message Reject	07h	Either the initiator or the autoloader is indicating that the last message received was inappropriate or not implemented.
No Operation	08h	The initiator informs the autoloader that it does not have a valid message to send in response to the autoloader's request for a message.
Message Parity Error	09h	The initiator informs the autoloader that one or more bytes in the last message it received had a parity error.
Target Reset	0Ch	The initiator instructs the autoloader to reset all of its current I/O operations for all initiators. The autoloader releases the SCSI bus into the Bus Free phase, with no operations pending for any initiator, and performs a reset. (See page 3-2 for more information about resetting the autoloader.)
Ignore Wide Residue	23h	The autoloader sends the Ignore Wide Residue message to indicate that the number of valid bytes sent was less than the negotiated transfer width.
Identify	80h or C0h	This message is used to establish a physical path connection between the initiator and the autoloader. It also indicates whether disconnect is supported and the LUN for which the command is intended. The autoloader supports a LUN of 0.

2.4 SCSI COMMAND PROTOCOL

This section describes the SCSI commands supported by the autoloader. The host (or initiator) uses these commands to interact with the autoloader. This section also describes the command status information returned by the autoloader.

2.4.1 SUPPORTED SCSI COMMANDS

The initiator sends commands to the autoloader to request an operation. Chapter 4 through Chapter 25 contain the detailed descriptions of the SCSI commands. The commands are arranged in alphabetical order with each command starting in a new chapter. For ease of reference, the command name and operation code (OP code) are included in the header at the top of each page.

Table 2-3 lists and briefly describes the SCSI commands supported by the autoloader.

Note: The commands issued to the autoloader are independent of the commands issued to the tape drive. For information about the commands for the tape drive, refer to the documentation for the tape drive.

Table 2-3 *SCSI command set supported by the autoloader*

When you issue this command …	OP Code	The autoloader does this …	Discussed in...
INITIALIZE ELEMENT STATUS (6 bytes)	07h	Checks all element addresses for cartridges and scans bar code labels.	Chapter 4
INITIALIZE ELEMENT STATUS WITH RANGE (10 bytes) (Exabyte-unique command)	E7h	Checks a range of elements or all the storage elements for cartridges and scans bar code labels.	Chapter 5
INQUIRY (6 bytes)	12h	Sends information about its parameters, including the autoloader serial number, to the initiator.	Chapter 6
LOG SELECT (10 bytes)	4Ch	Manages statistical information maintained by the autoloader.	Chapter 7
LOG SENSE (10 bytes)	4Dh	Returns statistical and condition information to the initiator.	Chapter 8
MODE SELECT (6 bytes)	15h	Accepts specific element addresses, LCD information, and operating parameters from the initiator. Can also prevent access to selected operator panel menus.	Chapter 9
MODE SENSE (6 bytes)	1Ah	Reports its operating mode parameters to the initiator.	Chapter 10
MOVE MEDIUM (12 bytes)	A5h	Moves a cartridge from one location to another.	Chapter 11

Table 2-3 *SCSI command set supported by the autoloader (continued)*

When you issue this command …	OP Code	The autoloader does this …	Discussed in...
POSITION TO ELEMENT (10 bytes)	2Bh	Positions the cartridge loader at a specific location (element address).	Chapter 12
PREVENT/ALLOW MEDIUM REMOVAL (6 bytes)	1Eh	Disables or enables the interlock mechanism in the cartridge access port, preventing or allowing the user from accessing cartridges through the cartridge access port.	Chapter 13
READ BUFFER (10 bytes)	3Ch	Copies the autoloader's microcode or dump file across the SCSI bus to the initiator. Used in conjunction with the WRITE BUFFER command.	Chapter 14
READ ELEMENT STATUS (12 bytes)	B8h	Reports the status of its medium transport, storage, and data transfer elements to the initiator.	Chapter 15
RECEIVE DIAGNOSTIC RESULTS (6 bytes)	1Ch	Returns diagnostic results from the last SEND DIAGNOSTIC command.	Chapter 16
RELEASE (6 bytes or 10 bytes)	17h 57h	Releases elements (or the entire unit) from reservations previously set by the initiator using the RESERVE command.	Chapter 17
REQUEST SENSE (6 bytes)	03h	Returns sense data to the initiator.	Chapter 18
REQUEST VOLUME ELEMENT ADDRESS (12 bytes)	B5h	Returns the element descriptors (including element address and status flags for each element) created as a result of the SEND VOLUME TAG command. Data is returned in element address order.	Chapter 19
RESERVE (6 bytes or 10 bytes)	16h 56h	Reserves specific elements within the autoloader or the entire unit for the initiator's use.	Chapter 20
REZERO UNIT (6 bytes)	01h	Implemented to provide software compatibility when it is required. Because the autoloader does not need to calibrate its mechanics, it always returns and immediate Good status in response to this command.	Chapter 21
SEND DIAGNOSTIC (6 bytes)	1Dh	Requests that a self test or another specific test be performed.	Chapter 22
SEND VOLUME TAG (12 bytes)	B6h	Compares the template it receives from the initiator to the cartridge inventory information in memory, and determines which bar code labels match the template.	Chapter 23

Table 2-3 *SCSI command set supported by the autoloader (continued)*

When you issue this command …	OP Code	The autoloader does this …	Discussed in...
TEST UNIT READY (6 bytes)	00h	Informs the initiator whether it is ready to accept all other commands.	Chapter 24
WRITE BUFFER (10 bytes)	3Bh	Writes new microcode received from the initiator into its flash EEPROM. The new microcode must be sent in sections through multiple WRITE BUFFER commands.	Chapter 25

2.4.2 SCSI COMMAND FORMAT

The autoloader uses six-, ten-, and twelve-byte commands, whose formats are described in the SCSI-3 standards (SPC-2, SMC, SAM-2, SPI-2). Any command descriptor block (CDB) fields that are specific to the autoloader for a given command are described in the command chapter. This section describes the CDB fields that are common for every command.

Note: Any errors caused by illegal parameters in a CDB or parameter list for a particular command are listed at the end of the command chapter. Errors of this type return a sense key of Illegal Request (5h).

- The word *Reserved* or *RSVD* has one of the following meanings when used in a SCSI command field definition:
  - The field is defined as reserved by the *ANSI Small Computer System Interface (SCSI)* standard. The autoloader checks these fields for a value of 0. If zeros are not present, the autoloader returns Check Condition status with the sense key set to Illegal Request (5h).
  - The field description, "This field not supported by the autoloader," indicates that the field is supported by the SCSI-3 standards, but has not been defined in the Exabyte implementation of the command. These fields are reserved for future enhancements. The autoloader ignores these fields and does not check for illegal values.
- The vendor unique portion of the Control byte (as indicated in the SCSI standard) is defined for each specific command, if used. The autoloader does not support linked commands or recognize the Flag bit.
- Fields containing only one bit are usually referred to as the name bit instead of the name field.
- Numbers that are not immediately followed by lower-case b or h are decimal values.
- Numbers immediately followed by lower-case b (*nn*b) are binary values.

- Numbers or upper case letters immediately followed by lower-case h (*nn*h) are hexadecimal values.

2.4.3 COMMAND STATUS

The autoloader sends one status byte to the initiator at the completion of a command. The status byte is formatted as follows:

Bit / Byte	7	6	5	4	3	2	1	0
00	Reserved		Status Byte Code					

Table 2-4 contains a summary of the status bytes used by the autoloader.

Note: The autoloader may go to the Bus Free phase without reporting status in response to a command sequence. If this happens, immediately issue a REQUEST SENSE (03h) command to determine the cause of the unexpected disconnect.

Table 2-4 *SCSI command status bytes supported by the autoloader*

Status	Hex Value	Description
Good	00h	Indicates that the autoloader successfully completed the operation specified by the CDB.
Check Condition	02h	Indicates an error, exception, or abnormal condition that has caused sense information to be set.
Busy	08h	Indicates that the autoloader is unable to accept a command from an initiator.
Reservation Conflict	18h	Indicates that the elements identified in the command are reserved by another initiator.

Status Descriptions

The following are expanded descriptions of the status bytes listed in Table 2-4.

Good The autoloader returns Good status to indicate that the operation specified by the CDB completed normally.

Check Condition The autoloader returns Check Condition status to indicate that an error has occurred while it was executing a command. The autoloader reports Check Condition status as soon as it detects the error unless it is disconnected from the SCSI bus. If the autoloader is disconnected, it reports Check Condition status after the reconnect process.

Examples of situations that result in Check Condition status are listed below:

- You send an Identify message with an invalid LUN followed by a command other than INQUIRY or REQUEST SENSE.
- You send a command other than INQUIRY or REQUEST SENSE when there is a pending Unit Attention condition of the autoloader.
- The autoloader has an unrecoverable hardware error and receives a motion command.
- The autoloader is not ready when it receives a motion command.
- You set a reserved field to a value other than 0 in the CDB or the parameter list for the requested command.
- You specify an invalid parameter in the CDB or parameter list for the requested command.
- The command fails for one of the reasons listed in the command chapter. For example, a MOVE MEDIUM command terminates with Check Condition status if the source for the move is empty.
- For specific situations that return Check Condition status, refer to the command descriptions in Chapter 4 through Chapter 25.

Busy The autoloader returns Busy status to any initiator that sends a command other than INQUIRY or REQUEST SENSE when the autoloader is disconnected from the SCSI bus or when it is waiting for a SCSI motion process to be aborted.

- If allowed, the autoloader disconnects from the SCSI bus when performing any lengthy operations, such as a move operation.
- The autoloader aborts motion processes in response to an Abort Task Set message from the initiator that requested the motion command. The autoloader has to abort the motion process completely before it can process commands other than INQUIRY and REQUEST SENSE.

Reservation Conflict The autoloader returns Reservation Conflict status to indicate that either the entire autoloader or the elements requested to be accessed are currently reserved by another initiator. This status is reported until the initiator that reserved the autoloader or elements issues a RELEASE (17h or 57h) command or a reset condition occurs.

2.4.4 COMMAND FORMAT ERRORS

A command format error may occur when:

- The Operation Code in the CDB is not supported by the autoloader.
- The value of the bytes or bits in a Reserved field (as defined by the SCSI standard) is not 0.

- The value of the Link or Flag fields in the Control byte (bits 1 and 0) of the CDB are not 0, or the value of the Vendor Unique fields (bits 7 and 6) are not valid as defined for the specific command.

For all command format errors, the autoloader terminates the command and returns Check Condition status to the initiator. The sense data is set as follows:

- The sense key is set to Illegal Request (5h).
- Depending on the specific error, the Additional Sense Code (ASC) is set to Illegal Operation Code (20h), Logical Unit Not Supported (25h), or Invalid Field in CDB (24h).
- The Additional Sense Code Qualifier (ASCQ) is set to 0.
- The sense key specific data indicates the location of the error.

Notes

3

IMPLEMENTING SCSI OPERATIONS

This chapter provides information about performing the following common SCSI operations:

- Resetting the autoloader
- Setting element addresses
- Using the cartridge inventory
- Moving cartridges
- Reserving elements
- Inquiring about the status of a specific operation
- Performing diagnostic tests
- Copying microcode

For detailed information about the SCSI commands that the autoloader uses to perform these operations, refer to Chapter 4 through Chapter 25.

3.1 DISCONNECTING FROM THE SCSI BUS

The autoloader disconnects from the SCSI bus to process a command that requires a lengthy amount of time, thereby freeing the SCSI bus to allow another I/O process to occur. The autoloader can disconnect from the SCSI bus only if it has been granted permission to do so by the initiator.

While disconnected from the SCSI bus, processing a command, or trying to reconnect to the initiator, the autoloader returns Busy status or Check Condition status (Not Ready) to other initiators requesting commands other than REQUEST SENSE (03h) and INQUIRY (12h). If the same initiator selects the autoloader to request another command, the autoloader returns Check Condition status (Overlapped Commands).

3.2 RESETTING THE AUTOLOADER AND TAPE DRIVE

You can use any of the following methods to reset the autoloader and its tape drive.

! Important When active termination of the SCSI bus is used, powering off the device that supplies terminator power for the SCSI bus leaves the RST line in an indeterminate state (either reset or not, depending on the voltages). In this situation, it may be impossible to communicate with the autoloader.

- **Power-on reset.** Power the autoloader off and back on again to reset the autoloader and its tape drive.
- **Operator panel reset.** When you select Reset autoloader from the Diagnostics menu and press ✱, a confirmation screen appears. Press ✱ to begin the reset (or ⏏ to cancel the reset). The autoloader resets and performs a cartridge inventory. When the reset is complete, the Home screen appears.
- **SCSI bus reset.** Send a RST pulse on the SCSI bus for a minimum of 25 µsec. A SCSI bus reset immediately clears all devices from the bus, resets their associated equipment, and terminates all pending I/O processes.
- **SCSI Target Reset message.** Issue a Target Reset (0Ch) message to the autoloader or a tape drive to reset the individual device. A Target Reset message clears the device from the bus, causes all commands sent to it to be cleared, and terminates all pending I/O processes. Note that a Target Reset message received by the autoloader does not reset the tape drive or the SCSI bus.

Note: If the autoloader is performing a cartridge move operation when it is reset, it completes the move operation during POST.

3.2.1 EFFECT OF POWER-ON RESETS

The power-on reset has the following effects:

- The checksum of the flash code is validated.
- All autoloader parameters are reset to their default or saved values.
- The autoloader performs its power-on self-test.
- A power-on reset of the autoloader also resets the tape drive and causes them to perform their power-on self tests.

After a power-on reset, the autoloader will respond on the SCSI bus within 15 seconds.

3.2.2 EFFECT OF OPERATOR PANEL RESETS

An operator panel reset has the following effects:

- If the autoloader is connected to the SCSI bus, the SCSI bus goes to the Bus Free phase.
- The checksum of the autoloader's flash code is validated.
- All autoloader parameters are reset to their default or saved values.
- The autoloader performs its power-on self-test.

After an operator panel reset, the autoloader will respond on the SCSI bus within 15 seconds.

3.2.3 EFFECT OF SCSI BUS AND BUS DEVICE RESETS

A SCSI bus reset or device reset has the following effects:

- If the autoloader is connected to the SCSI bus, the SCSI bus goes to the Bus Free phase.
- All autoloader parameters are reset to their default or saved values.
- A SCSI bus reset also resets the tape drive.

After a SCSI bus or device reset, the autoloader will respond on the SCSI bus within 250 msec.

3.3 SETTING ELEMENT ADDRESSES

If you want, you can assign different element addresses to the autoloader's tape drive, cartridge loader, and cartridge cells (the data transfer, medium transport, and storage elements, respectively). The Figure 2-1 on page 2-3 shows the default element address assigned to each element in the autoloader.

If desired, you can use the MODE SELECT (15h) command to change the element addresses assigned to the different types of elements. The element addresses for the cartridge cells are numbered consecutively, with the first address being the starting element address that you specify for the storage elements. To view the current addresses, use the MODE SENSE (1Ah) command.

3.4 UNDERSTANDING THE CARTRIDGE INVENTORY

The autoloader maintains a cartridge inventory in volatile memory. The inventory is automatically re-established whenever the autoloader is powered on or whenever the cartridge access port door is opened, then closed again. The inventory contains information about the following element locations:

- Medium transport element (the carousel/cartridge loader)
- Storage elements (the seven cartridge cells)
- Data transfer element (the tape drive)

The autoloader uses the information stored in the cartridge inventory to process SCSI commands.

3.4.1 ESTABLISHING THE CARTRIDGE INVENTORY

The autoloader automatically updates the cartridge inventory when it is powered on or whenever the cartridge access port door is opened, then closed again. You can use the INITIALIZE ELEMENT STATUS (07h) or INITIALIZE ELEMENT STATUS WITH RANGE (E7h) command to attempt reading a bar code label that could not be read during the most current cartridge inventory operation.

3.4.2 RETRIEVING CARTRIDGE INVENTORY INFORMATION

After the current cartridge inventory has been determined using an INITIALIZE ELEMENT STATUS command, you can retrieve the inventory information by issuing a READ ELEMENT STATUS (B8h) command (see Chapter 15).

3.4.3 TYPES OF INFORMATION STORED IN THE CARTRIDGE INVENTORY

As described in this section, the cartridge inventory contains the following information for every element location:

- Element address
- Element occupied status
- Bar code label information
- SCSI element reservation information
- Tape drive accessible status
- Cartridge pick and put (place) retry counts
- Total number of cartridge picks and puts (places)
- Source element address

Element Addresses

The cartridge inventory contains an Element Address field for each element location. You use element addresses to reference element locations when you issue SCSI commands to the autoloader, when specifying sources and destinations for operator panel move operations, and when performing diagnostics. The default element addresses for the autoloader are listed in Table 3-1 and shown in Figure 2-1 on page 2-3. If desired, you can change element addresses using the MODE SELECT (15h) command (see Chapter 9).

Table 3-1 *Default element addresses*

Element Type	Default Element Address
All storage elements	1h to 7h
Data transfer element (tape drive)	52h
Medium transport (cartridge loader and carousel)	56h

Element Occupied Status

The autoloader uses the Occupied and Occupied Valid flags in the cartridge inventory to determine whether a given element is occupied as follows:

Occupied The Occupied flag indicates whether the autoloader considers the specified element location to contain a data cartridge, as follows:

0 – The element location does not contain a data cartridge
1 – The element location contains a data cartridge

Occupied Valid The Occupied Valid flag indicates whether the Occupied flag is accurate, as follows:

0 – The Occupied flag is questionable (may not be accurate)
1 – The Occupied flag is accurate

Bar Code Label Information

! Important This information is available only if bar code labels are attached to each cartridge. Refer to the *Magnum 1x7 LTO Autoloader Product Manual* for information about placing the labels on the cartridges.For specifications for the bar code labels that can be used with the autoloader, refer to the *Exabyte Bar Code Specification for LTO Ultrium Cartridges*.

The autoloader uses the following fields in the cartridge inventory to indicate bar code label information:

- Label
- Label Valid
- Label Error
- Label Scan Retries

- Send Volume Match

These fields are used only if you have attached bar code labels to each data cartridge and you have scanned the labels. Descriptions of these fields follow:

Label If the element location contains a cartridge whose bar code label has been scanned, the Label field contains the cartridge label.

Label Valid The Label Valid field indicates whether the Label field is accurate, as follows:

0 – The Label field is not accurate
1 – The Label field is accurate

The Label Valid flag is set to 0 after the autoloader is reset or when the cartridge access port door is opened to indicate that a cartridge may have been added or removed from the location. The Label Valid flag is set to 1 when the label is successfully scanned.

Label Error The Label Error field indicates whether the bar code scanner was unable to read the cartridge label, as follows:

0 – The bar code scan was successful, a reset condition occurred, or the cartridge access port door was opened.

60 – The bar code scanner could not read the bar code label because there was no label on the cartridge.

61 – A bar code label was detected but could not be read.

65 – The bar code label could not be read because of a hardware error.

Label Scan Retries The Label Scan Retries field contains the total number of bar code scanner retries for each cartridge. This field is cleared when the autoloader is reset.

Send Volume Match The Send Volume Match flag indicates whether the cartridge label matched the template sent with the last SEND VOLUME TAG (B6h) command, as follows:

0 – The label did not match the template
1 – The label matched the template

The REQUEST VOLUME ELEMENT ADDRESS (B5h) command references the Send Volume Match flag for the cell and sets it to 0 after the label information is returned to the initiator. This flag is also set to 0 when the autoloader is reset or when the cartridge access port door is opened.

SCSI Element Reservation

Using the RESERVE (16h or 56h) command, an initiator can either reserve the entire autoloader as a unit or specific elements for its exclusive use. The autoloader uses three fields to indicate element reservation by an initiator:

Reserved The Reserved flag indicates whether the element is reserved by an initiator, as follows:

0 – The element is not reserved
1 – The element is reserved

Host ID The Host ID field contains the SCSI ID of the initiator that reserved the element.

Reservation ID The Reservation ID field contains the reservation ID as set in the RESERVE command.

Note: When the autoloader is reset, all reservation information is cleared. For more information about the RESERVE command, see Chapter 20.

Tape Drive Accessible

The Tape Drive Accessible flag indicates whether the tape drive is empty, a cartridge is loaded in the tape drive, or the cartridge is ejected, as follows:

0 – A cartridge may be loaded in the drive
1 – The drive is empty, or the cartridge is unloaded or ejected and ready to be picked

This flag is set to 0 when the autoloader loads a cartridge in the tape drive and after the autoloader is reset or the cartridge access port door is opened.

This flag is set to 1 when the autoloader detects that the tape drive is accessible. The autoloader can detect that the drive is accessible after a move operation, after a cartridge scan operation, or when the tape drive notifies the autoloader that it is accessible.

Cartridge Pick and Put Retry Counts

The Cartridge Pick Retry Counts and Cartridge Put Retry Counts fields indicate the total number of pick/put operation retries for each element location. Note that the pick from one element location and put to another are accomplished in a single motion. These fields are cleared when the autoloader is reset.

Total Number of Cartridge Puts

The Total Number of Cartridge Puts field indicates the total number of put operations for each element location. Each time a cartridge is moved to an element location, the total number of puts for that location is incremented. Note that the pick from one element location and put to another are accomplished in a single motion. This field is cleared when the autoloader is reset.

Source Element Address

The Source Element Address field shows the address of the last storage element from which the cartridge was moved.

3.5 MOVING CARTRIDGES

To instruct the autoloader to move cartridges between a storage location and the tape drive, issue the MOVE MEDIUM (A5h) command. The MOVE MEDIUM command allows you to specify a source element address and a destination element address for a specific move operation.

3.6 RESERVING ELEMENTS

To reserve the entire autoloader for exclusive use by one initiator, use either form of the RESERVE (16h or 56h) command, as follows:

- To reserve specific elements within the autoloader, use the six-byte RESERVE (16h) command.
- To perform a 3rd Party reservation, use the ten-byte RESERVE (56h) command.
- To reserve the entire autoloader as a unit, use either form of the RESERVE command.

Note: Use a tape drive's RESERVE UNIT command to ensure that the initiator has exclusive use of the tape drive for tape operations.

When an initiator reserves the entire autoloader or an element within the autoloader, the same initiator must use the RELEASE (17h or 56h) command to cancel the reservation.

3.7 INQUIRING ABOUT AUTOLOADER STATUS

To inquire about the autoloader status, you can use the following commands:

TEST UNIT READY (00h) Command

Use this command to determine if the autoloader is ready to accept all other valid commands, including motion commands. This is not a request for a self-test, which occurs at power-on. This command returns Good status if the autoloader is ready to accept any valid command without returning Check Condition, Reservation Conflict, or Busy status.

REQUEST SENSE (03h) Command

If an error occurs during an operation, use the REQUEST SENSE (03h) command to determine the type of error. This command returns the following information:

- Sense key for the error indicating the type of error (Not Ready, Hardware Error, Illegal Request, Unit Attention, or Aborted Command)
- Additional sense code (ASC) indicating the type of error in the given sense key category
- Additional sense code qualifier (ASCQ) indicating the specific error in the sense key and ASC categories

INQUIRY (12h) Command

Use the INQUIRY (12h) command to obtain the autoloader's Product Identification and Vendor ID. You can also obtain information about the autoloader's microcode level and the version of SCSI supported by the autoloader.

LOG SENSE (4Dh) Command

Use the LOG SENSE command to retrieve the autoloader's statistical and state information. This type of information includes the following:

- Tape Alert flags
- System statistics
- Element statistics
- Cartridge scan retries
- Environmental data
- Command failure information

3.8 PERFORMING DIAGNOSTICS

You can perform diagnostics to find out detailed information about autoloader operations. The SEND DIAGNOSTIC (1Dh) command allows you to run special diagnostic tests. The RECEIVE DIAGNOSTIC RESULTS (1Ch) command allows you to obtain diagnostic results of autoloader operations.

3.9 COPYING MICROCODE

If you want to copy the microcode (also known as firmware) to the host, or if new microcode becomes available, use the READ BUFFER (3Ch) and WRITE BUFFER (3Bh) commands, as follows:

- Use the READ BUFFER command to read the microcode from the autoloader's flash memory (EEPROM).
- Use the WRITE BUFFER command to load new microcode across the SCSI bus from the initiator to the autoloader's flash memory.

4

INITIALIZE ELEMENT STATUS (07h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	1	1	1
01	Reserved							
02	Reserved							
03								
04								
05	NBL	Reserved						

4.1 About This Command

The INITIALIZE ELEMENT STATUS command causes the autoloader to attempt reading any bar code labels that were unreadable during the automatic cartridge inventory. The autoloader checks the elements in ascending element address order (see Section 2.2 on page 2-2 for more information about element addresses). The information obtained by this command can be returned to the initiator using the READ ELEMENT STATUS (B8h) command. For specific information about the time required to complete this command, refer to the *Magnum 1x7 LTO Autoloader Product Manual*.

Notes:

- Support for the INITIALIZE ELEMENT STATUS command is provided for compatibility. The autoloader automatically re-establishes the cartridge inventory immediately after power-on or whenever the cartridge access port door is opened, then closed again. Issuing a INITIALIZE ELEMENT STATUS command causes the autoloader to attempt reading any bar code labels that were unreadable during the most current inventory operation.
- For specifications for the bar code labels that can be used with the autoloader, refer to the *Exabyte Bar Code Label Specification for LTO Ultrium Cartridges*.

- For best bar code scan results, refer to *Magnum 1x7 LTO Autoloader Product Manual* for information about positioning the bar code labels on data cartridges.
- The bar code scanner is in a fixed position behind the cartridge access port. The autoloader cannot scan a label on a cartridge that is in or protruding from the tape drive.

4.2 WHAT YOU SEND TO THE AUTOLOADER

NBL (No Barcode Labels) – Byte 05, Bit 7

The autoloader ignores this bit. If a cartridge does not have a bar code label, the cartridge inventory indicates that the label is unreadable.

4.3 EFFECTS ON THE CARTRIDGE INVENTORY

The autoloader updates the cartridge inventory whenever it is powered on or whenever the cartridge access port door is opened, then closed again. During the inventory it checks for the presence of a cartridge at each location and scans the bar code labels. This section describes how the autoloader updates the cartridge inventory.

Table 4-1 through Table 4-3 illustrate the various outcomes of a requested scan operation and the effect on the cartridge inventory.

- A request is made to scan a cartridge in a storage location and the scan operation completed successfully (the bar code scanner was able to read the label on the cartridge or the location was empty). See Table 4-1 for details about how the cartridge inventory is updated.

Table 4-1 *Effect on the cartridge inventory of a cartridge scan in a storage location*

This cartridge inventory field...	... is changed to the following when...	
	... the location is empty	... the location is full
Occupied	0	1
Occupied Valid	1	1
Label	blanks	cartridge label
Label Valid	0	1
Label Scan Retries	0	updated if retried
Source Storage Element Address	no change	no change

- A request is made to check for the presence of a cartridge in a storage location and the operation completed successfully. See Table 4-2 for more information about how the cartridge inventory is updated.

Table 4-2 *Effect on the cartridge inventory of a request to check the occupied status of a storage location*

This cartridge inventory field...	... is changed to the following when...	
	... the location is empty	... the location is full
Occupied	0	1
Occupied Valid	1	1
Label	blanks	no change
Label Valid	0	no change
Label Scan Retries	0	no change
Source Storage Element Address	no change	no change

- A request is made to scan a cartridge in a storage location and the operation failed because the bar code scanner was unable to read the label on the cartridge or if the cartridge does not have a label. The scan will not fail if the location is empty. See Table 4-3 for details about how the cartridge inventory is updated.

Table 4-3 *Effect on the cartridge inventory when a request for a cartridge scan fails*

This cartridge inventory field...	...is changed to the following when the autoloader cannot read the cartridge label
Occupied	1
Occupied Valid	1
Label	blanks
Label Valid	0
Label Scan Retries	updated if retried
Source Storage Element Address	no change

4.4 COMMAND STATUS

The autoloader returns a status byte after processing the INITIALIZE ELEMENT STATUS command as follows:

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status when it or the cartridge loader is reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

Check Condition status is returned for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects a parity error while receiving the CDB and the message system is not enabled.
- A Unit Attention condition is pending for the initiator.
- The autoloader has experienced an unrecoverable hardware error.
- The autoloader encounters a problem while scanning the cartridges.
- The autoloader is not ready because the cartridge access port door is open.
- A parameter in the CDB is invalid (see Table 4-4 for sense data).

Table 4-4 *Invalid parameters in the INITIALIZE ELEMENT STATUS CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.

5

INITIALIZE ELEMENT STATUS WITH RANGE (E7h)

Bit Byte	7	6	5	4	3	2	1	0
00	1	1	1	0	0	1	1	1
01	Reserved							Range
02	(MSB)	Element Address						
03								(LSB)
04	Reserved							
05								
06	(MSB)	Number of Elements						
07								(LSB)
08	Reserved							
09	NBL	Reserved						

5.1 About This Command

The INITIALIZE ELEMENT STATUS WITH RANGE command is an Exabyte-unique command that causes the autoloader to attempt reading any bar code labels that were unreadable during the automatic cartridge inventory. The information obtained by this command can be returned to the initiator using the READ ELEMENT STATUS (B8h) command. For specific information about the time required to complete this command, refer to the *Magnum 1x7 LTO Autoloader Product Manual*.

Notes:

- Support for the INITIALIZE ELEMENT STATUS WITH RANGE command is provided for compatibility. The autoloader automatically re-establishes the cartridge inventory immediately after power-on or whenever the cartridge access port door is opened, then closed again. Issuing a INITIALIZE ELEMENT STATUS WITH RANGE command causes the autoloader to attempt reading any bar code labels that were unreadable during the most current inventory operation.
- For specifications for the bar code labels that can be used with the autoloader, refer to the *Exabyte Bar Code Label Specification for LTO Ultrium Cartridges*.
- For best bar code scan results, refer to *Magnum 1x7 LTO Autoloader Product Manual* for information about positioning the bar code labels on data cartridges.
- The bar code scanner is in a fixed position behind the cartridge access port. The autoloader cannot scan a label on a cartridge that is in or protruding from the tape drive.

5.2 WHAT YOU SEND TO THE AUTOLOADER

Range – Byte 01, Bit 0

The Range field indicates which elements are to be checked, as follows:

0 – Initialize all elements
1 – Initialize the range of elements specified by the Element Address and Number of Elements fields

Element Address – Bytes 02 and 03

This field specifies the address of the element or the starting address of a series of elements to be checked. This field is ignored when the Range field is 0. Figure 2-1 on page 2-3 shows the default element addresses for the autoloader.

Note: When the Range field is set to 1, the specified address must be a valid element address.

Number of Elements – Bytes 06 and 07

This field indicates the maximum number of elements to be checked. This field is ignored when the Range field is 0.

If an initialize element status operation is performed on the cartridge loader, the request does not count toward the total number of elements requested in the Number of Elements field.

NBL (No Barcode Labels) – Byte 05, Bit 7

The autoloader ignores this field. If a cartridge does not have a bar code label, the cartridge inventory indicates that the label is unreadable.

5.3 EFFECTS ON THE CARTRIDGE INVENTORY

The autoloader updates the cartridge inventory whenever it is powered on or whenever the cartridge access port door is opened, then closed again. During the inventory it checks for the presence of a cartridge at each location and scans the bar code labels. This section describes how the autoloader updates the cartridge inventory.

Table 5-1 through Table 5-3 illustrate the various outcomes of a requested scan operation and the effect on the cartridge inventory.

- A request is made to scan a cartridge in a storage location and the scan operation completed successfully (the bar code scanner was able to read the label on the cartridge or the location was empty). See Table 5-1 for details about how the cartridge inventory is updated.

Table 5-1 *Effect on the cartridge inventory of a cartridge scan in a storage location*

This cartridge inventory field...	... is changed to the following when...	
	... the location is empty	... the location is full
Occupied	0	1
Occupied Valid	1	1
Label	blanks	cartridge label
Label Valid	0	1
Label Scan Retries	0	updated if retried
Source Storage Element Address	no change	no change

- A request is made to check for the presence of a cartridge in a storage location and the operation completed successfully. See Table 5-2 for more information about how the cartridge inventory is updated.

Table 5-2 *Effect on the cartridge inventory of a request to check the occupied status of a storage location*

This cartridge inventory field...	... is changed to the following when...	
	... the location is empty	... the location is full
Occupied	0	1
Occupied Valid	1	1
Label	blanks	no change
Label Valid	0	no change
Label Scan Retries	0	no change
Source Storage Element Address	no change	no change

- A request is made to scan a cartridge in a storage location and the operation failed because the bar code scanner was unable to read the label on the cartridge or if the cartridge does not have a label. The scan will not fail if the location is empty. See Table 5-3 for details about how the cartridge inventory is updated.

Table 5-3 *Effect on the cartridge inventory when a request for a cartridge scan fails*

This cartridge inventory field...	...is changed to the following when the autoloader cannot read the cartridge label
Occupied	1
Occupied Valid	1
Label	blanks
Label Valid	0
Label Scan Retries	updated if retried
Source Storage Element Address	no change

5.4 COMMAND STATUS

The autoloader returns a status byte after processing the INITIALIZE ELEMENT STATUS WITH RANGE command as follows:

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status when it or the cartridge loader is reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

Check Condition status is returned for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects a parity error while receiving the CDB and the message system is not enabled.
- A Unit Attention condition is pending for the initiator.
- The autoloader has experienced an unrecoverable hardware error.
- The autoloader encounters a problem while scanning the cartridges.
- The autoloader is not ready because the cartridge access port door is open.
- A parameter in the CDB is invalid (see Table 5-4 for sense data).

Table 5-4 *Invalid parameters in the INITIALIZE ELEMENT STATUS WITH RANGE CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.

Notes

6

INQUIRY (12h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	0	1	0
01	Reserved							EVPD
02	Page Code							
03	Reserved							
04	Allocation Length							
05	0	0	Reserved				0	0

6.1 About This Command

The INQUIRY command requests that the autoloader send information regarding its parameters to the initiator. The autoloader can return two categories of data in response to this command:

- Standard Inquiry Data, described starting on page 6-3, contains basic information about the autoloader, including the product identification.
- Vital Product Data, described starting on page 6-8, contains additional detailed information about the autoloader. Each Vital Product Data page requires a separate INQUIRY command from the initiator.

6.2 WHAT YOU SEND TO THE AUTOLOADER

EVPD (Enable Vital Product Data) – Byte 01, Bit 0

This bit indicates the type of inquiry data you are requesting, as follows:

0 – Standard inquiry data (described on page 6-3).
1 – Vital product data (described on page 6-8), based on the Page Code field (byte 02).

Page Code – Byte 02

This field contains the page number of the vital product data page to be returned for this INQUIRY command. The autoloader supports the following page codes:

00h – Supported Vital Product Data page
80h – Unit Serial Number page
83h – Device Identification page
C0h – Original Data page
F0h – Code Level page

If the EVPD bit is set to 0, the Page Code must be 00h.

Allocation Length – Byte 04

This field specifies the number of bytes that the initiator has allocated for returned inquiry data. A value of 0 indicates that no inquiry data is to be transferred. This condition is not an error.

The autoloader terminates the Data In phase when it has transferred either the number of bytes specified by the Allocation Length field or all of the available inquiry data, whichever is less. The lengths for inquiry data returned by the autoloader are:

- 6Ch (108) bytes for the Standard Inquiry Data
- 0Ah (10) bytes for the Supported Vital Product Data page
- 10h (16) bytes for the Unit Serial Number page
- 2Ch (44) bytes for the Device Identification page
- 6Ch (108) bytes for the Original Data page
- 60h (96) bytes for the Code Level page

6.3 WHAT THE AUTOLOADER RETURNS

When the EVPD bit (byte 01, bit 0) is 0, the autoloader returns 108 bytes of Standard Inquiry Data, as described in the following section.

6.3.1 STANDARD INQUIRY DATA PAGE

Bit / Byte	7	6	5	4	3	2	1	0
00	Peripheral Qualifier				Peripheral Device Type			
01	RMB	Reserved						
02	Version							
03	AERC	RSVD	Norm ACA	HiSup	Response Data Format			
04	Additional Length							
05	SCCS	Reserved						
06	BQue	EncServ	RSV	MultiP	MChngr	RSVD	RSVD	Addr16
07	RelAdr	RSVD	Wbus16	Sync	Linked	RSVD	Cmd Que	RSVD
08 ... 15	(MSB) Vendor Identification (LSB)							
16 ... 31	(MSB) Product Identification (LSB)							
32 ... 35	(MSB) Product Revision Level (LSB)							
36 ... 54	(MSB) Full Firmware Revision Level (LSB)							
55	Reserved							BarC
56	Reserved				Clocking		QAS	IUS
57	Reserved							
58 ... 73	Version Descriptors							

Bit / Byte	7	6	5	4	3	2	1	0
74 ... 95	Reserved							
96 ... 107	(MSB) Unit Serial Number (LSB)							

Peripheral Qualifier – Byte 00, Bits 7 through 5

The value returned for this field is 0, indicating that the autoloader is a single LUN device. If you specify a LUN other than 0 when you issue this command, the value returned for this field is 011b (binary), which indicates that the autoloader is not capable of supporting a physical device on the specified logical unit.

Peripheral Device Type – Byte 00, Bits 4 through 0

The value returned for this field is 08h, identifying the autoloader as a medium changer device. If you specify a LUN other than 0 when you issue this command, the value returned for this field is 1Fh, indicating that the peripheral device type is unknown. The remainder of the standard inquiry data is returned normally for the autoloader.

RMB (Removable Medium Bit) – Byte 01, Bit 7

The value returned for this field is 1, indicating that the media is removable.

Version – Byte 02

The value returned for this byte is 04h, indicating support of the current ANSI version of SPC-2 (SCSI Primary Commands – 2).

AERC (Asynchronous Event Reporting Capability) – Byte 03, Bit 7

The value returned for this field is 0, indicating that the autoloader does not support this function.

NormACA (Hierarchical Support) – Byte 03, Bit 5

The value returned for this field is 0, indicating that the autoloader does not support this function.

HiSup (Normal ACA Supported Bit) – Byte 03, Bit 5

The value returned for this field is 0, indicating that the autoloader does not support this function.

Response Data Format – Byte 03, Bits 3 through 0

The value returned for this field is 2h, indicating that the data is in accordance with SPC-2 (SCSI Primary Commands – 2).

Additional Length – Byte 04

The value returned for this field is 67h, indicating that there are 67h (103) additional bytes of inquiry data available to be returned to the initiator.

SCCS (SCC Supported) – Byte 05, Bit 7

The value returned for this field is 0, indicating that the autoloader does not support this function.

BQue (Basic Queuing) – Byte 06, Bit 7

The value returned for this field is 0, indicating that the autoloader does not support this tagged tasks.

EncServ (Enclosure Services) – Byte 06, Bit 6

The value returned for this field is 0, indicating that the autoloader does not support this function.

MultiP (Multi Port) – Byte 06, Bit 4

The value returned for this field is 0, indicating that the autoloader does not support this function.

MChngr (Medium Changer) – Byte 06, Bit 3

The value returned for this field is 0, indicating that the autoloader is not an attached media changer.

Addr16 (SCC Supported) – Byte 06, Bit 0

The value returned for this field is 1, indicating that the autoloader supports 16 SCSI IDs.

RelAdr (Relative Addressing) – Byte 07, Bit 7

The value returned for this field is 0, indicating that the autoloader does not support this function.

WBus16 (Wide Bus 16) – Byte 07, Bit 5

The value returned for this field is 1, indicating that the autoloader does support 16-bit-wide bus transfers.

Sync (Synchronous Transfer) – Byte 07, Bit 4

The value returned for this field is 1, indicating that the autoloader does support synchronous data transfer.

Linked (Linked Command) – Byte 07, Bit 3

The value returned for this field is 0, indicating that the autoloader does not support linked commands.

CmdQue (Command Queuing) – Byte 07, Bit 1

The value returned for this field is 0, indicating that the autoloader does not support tag command queuing.

Vendor Identification – Bytes 08 through 15

The value contained in these bytes is the ASCII representation of "EXABYTE" followed by a single space.

Product Identification – Bytes 16 through 31

The value contained in these bytes is the ASCII representation of the identifier, "LTO_1x7_2U_ _ _ _ _ _" where each "_" represents an ASCII space character.

Note: When one of the autoloader's emulation modes is selected from the operator panel, the autoloader can be used with most, but not all, SCSI drivers developed for the device being emulated. The Product Identification (bytes 16 through 31) returned by the autoloader depends on the emulation mode selected, as shown in Table 6-1.

Table 6-1 *Product Identification string returned by the autoloader when using an emulation mode*

When you select this emulation mode...	The autoloader returns this Product Identification string in response to an INQUIRY command...
Native 2-U	The default Product Identification stored in the autoloader's microcode.
AutoPak 110	"VXA_AutoPak_1x10" where each "_" represents an ASCII space character.
Exabyte EZ17	"Exabyte EZ17_ _ _ _" where each "_" represents an ASCII space character.
Exabyte 210	"EXB-210_ _ _ _ _ _ _ _ _" where each "_" represents an ASCII space character.

Firmware Revision Level – Bytes 32 through 35

The value contained in these bytes is the ASCII representation of the microcode revision level (for example, "0001" or other Exabyte microcode revisions) followed by sufficient spaces to fill the field.

Full Firmware Revision Level – Bytes 36 through 54

The value contained in these bytes is the ASCII representation of the full microcode revision level, and date (for example, "V1B003 092204").

BarC (Bar Code) – Byte 55, Bit 0

The value returned for this field is always 1, indicating that the autoloader has a bar code scanner installed.

Clocking – Byte 56, Bits 3 through 2

The value returned for this field is 00b, indicating that the autoloader supports only ST and not DT.

QAS (Quick Arbitration Supported) – Byte 56, Bit 1

The value returned for this field is 0, indicating that the autoloader does not support this function.

IUS (Information Units Supported) – Byte 56, Bit 0

The value returned for this field is 0, indicating that the autoloader does not support this function.

Version Descriptors – Bytes 58 through 73

Each Version Descriptor is a two byte field identifying a standard to which this device claims conformance. There are eight Version Descriptors.

Bit Byte	7	6	5	4	3	2	1	0
58	(MSB)			Version Descriptor 1 (003Bh)				
59				Conforms to SAM T10/0994 revision 18				(LSB)
60	(MSB)			Version Descriptor 2 (0AFBh)				
61				Conforms to SPI-2 T10/1142 revision 20b				(LSB)
62	(MSB)			Version Descriptor 3 (0269h)				
63				Conforms to SPC-2 T10/1236 revision 18				(LSB)
64	(MSB)			Version Descriptor 4 (01BBh)				
65				Conforms to SMC T10/0999 revision 10a				(LSB)
66	(MSB)			Version Descriptor 5(0000h)				
67				Not used				(LSB)
68	(MSB)			Version Descriptor6 (0000h)				
69				Not used				(LSB)
70	(MSB)			Version Descriptor7(0000h)				
71				Not used				(LSB)
72	(MSB)			Version Descriptor8(0000h)				
73				Not used				(LSB)

Unit Serial Number – Bytes 96 through 107

The value returned for this field is the serial number for the autoloader. The MSB is contained in byte 96. The autoloader serial number is set at the factory.

6.3.2 SUPPORTED VITAL PRODUCT DATA PAGE (PAGE CODE 00h)

When the EVPD bit is 1 and the Page Code is 00h, the autoloader returns the Supported Vital Product Data page as described below.

Bit / Byte	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	Page Code (00h)							
02	Reserved							
03	Page Length							
04	First Page Code Supported (00h – Supported Vital Product Data page)							
05	Second Page Code Supported (80h – Unit Serial Number page)							
06	Third Page Code Supported (83h – Device Identification page)							
07	Fourth Page Code Supported (C0h – Original Data page)							
08	Fifth Page Code Supported (F0h – Code Level page)							
09	Reserved							

Peripheral Qualifier – Byte 00, Bits 7 through 5

The value returned for this field is 0, which indicates that the autoloader is a single LUN device.

Peripheral Device Type – Byte 00, Bits 4 through 0

The value returned for this field is 08h, which identifies the autoloader as a medium changer device. If the LUN in the CDB is not 0, the value returned for this field is 7Fh, which indicates that the LUN is invalid.

Page Code – Byte 01

The value returned for this field is 00h, which is the Page Code for the Supported Vital Product Data page.

Page Length – Byte 03

The value returned for this field is 06h, which indicates that there are 6 bytes of data on this page (excluding this byte).

First Page Code Supported – Byte 04

The value returned for this field is 00h, which indicates support for the Supported Vital Product Data page.

Second Page Code Supported – Byte 05

The value returned for this field is 80h, which indicates support for the Unit Serial Number page.

Third Page Code Supported – Byte 06

The value returned for this field is 83h, which indicates support for the Device Identification page.

Fourth Page Code Supported – Byte 07

The value returned for this field is C0h, which indicates support for the Original Data page.

Fifth Page Code Supported – Byte 08

The value returned for this field is F0h, which indicates support for the Code Level page.

6.3.3 UNIT SERIAL NUMBER DATA PAGE (PAGE CODE 80h)

When the EVPD bit is 1 and the Page Code is 80h, the autoloader returns the Unit Serial Number page as described below.

Bit Byte	7	6	5	4	3	2	1	0
00	Peripheral Qualifier			Peripheral Device Type				
01	Page Code (80h)							
02	Reserved							
03	Page Length (0Ch)							
04 ... 13	(MSB) Unit Serial Number (LSB)							

Device Type Code – Byte 00

The value returned for this field is 08h, which identifies the autoloader as a medium changer device. If the LUN in the CDB is not 0, the value returned for this field is 7Fh, which indicates that the LUN is invalid.

Page Code – Byte 01

The value returned for this field is 80h, which is the Page Code for the Unit Serial Number page.

Page Length – Byte 03

The value returned for this field is 0Ch, which indicates the number of remaining bytes in this page (excluding this byte).

Unit Serial Number – Bytes 04 through 15

The value returned for this field is the serial number for the autoloader. The MSB is contained in byte 04. The autoloader serial number is set at the factory.

6.3.4 DEVICE IDENTIFICATION PAGE (PAGE CODE 83h)

The Device Identification page allows the autoloader to report its device identifiers, including its product identifier and serial number. The autoloader returns the Device Identification page when the EVPD bit in the CDB is 1 and the Page Code is 83h

Bit Byte	7	6	5	4	3	2	1	0
00	Peripheral Qualifier				Peripheral Device Type			
01	Page Code (83h)							
02	Reserved							
03	Page Length							
04	Reserved		Association		Code Set			
05	Reserved				Identifier Type			
06	Reserved							
07	Identifier Length							
08 ... 15	(MSB) Vendor Identification (LSB)							
16 ... 31	(MSB) Product Identification (LSB)							
32 ... 43	(MSB) Unit Serial Number (LSB)							

Peripheral Qualifier – Byte 00, Bits 7 through 5

The value returned for this field is 0, indicating that the autoloader is a single LUN device. If you specify a LUN other than 0 when you issue this command, the value returned for this field is 011b (binary), which indicates that the autoloader is not capable of supporting a physical device on the specified logical unit.

Peripheral Device Type – Byte 00, Bits 4 through 0

The value returned for this field is 08h, identifying the autoloader as a medium changer device. If you specify a LUN other than 0 when you issue this command, the value returned for this field is 1Fh, indicating that the peripheral device type is unknown. The remainder of the standard inquiry data is returned normally for the autoloader.

Page Code – Byte 01

The Page Code for the Device Identification Page is 83h.

Page Length – Byte 03

The Page Length for the Device Identification Page is 28h, indicating that there are 28h (40) additional bytes of inquiry data available to be returned to the initiator.

Code Set – Byte 04, Bits 3 through 0

The Code Set value is 2h, indicating that the identifier field contains ASCII data.

Vendor Identification – Bytes 08 through 15

The value contained in these bytes is the ASCII representation of "EXABYTE" followed by a single space.

Product Identification – Bytes 16 through 31

The value contained in these bytes is the ASCII representation of the product i, "LTO_1x7_2U", followed by six spaces. Each "_" represents an ASCII space character.

Unit Serial Number – Bytes 32 through 43

The value returned for this field is the serial number for the autoloader. The MSB is contained in byte 32. The autoloader serial number is set at the factory.

6.3.5 ORIGINAL DATA PAGE (PAGE CODE C0h)

The Original Inquiry Data page is a vendor-specific Inquiry Data page. It returns the Standard Inquiry Data for the autoloader as it was originally specified in the microcode. The page is formatted as shown on page 6-3. All of the Standard Inquiry Data that has been changed using the MODE SELECT (15h) command (86h) is replaced by the original values.

6.3.6 CODE LEVEL PAGE (PAGE CODE F0h)

The Code Level page is a vendor-specific Inquiry Data page. It provides revision level information about the following:

- The functional code currently stored in the autoloader EEPROM. This code controls the normal operation of the autoloader.
- The boot block code currently stored in the EEPROM. This code allows the functional code to be updated even if the code currently stored in the autoloader is inoperable.
- The self test code currently stored in the EEPROM.
- The Ethernet code currently stored in the EEPROM.

Bit Byte	7	6	5	4	3	2	1	0
00	Peripheral Qualifier				Peripheral Device Type			
01	Page Code (F0h)							
02	Reserved							
03	Page Length (5Ch)							
04 ... 07	(MSB) Reserved (LSB)							
08 ... 15	(MSB) Vendor Identification (LSB)							
16 ... 31	(MSB) Product Identification (LSB)							
32 ... 47	(MSB) Functional Code Level (LSB)							
48 ... 63	(MSB) Boot Block Code Level (LSB)							
64 ... 79	Internal Self Test Code Level							
80 ... 95	Ethernet Card Code Level							

Device Type Code – Byte 00

The value returned for this field is 08h, which identifies the autoloader as a medium changer device. If the LUN in the CDB is not 0, the value returned for this field is 7Fh, which indicates that the LUN is invalid.

Page Code – Byte 01

The value returned for this field is F0h, which is the Page Code for the Code Level page.

Page Length – Byte 03

The value returned for this field is 5Ch, which indicates that there are 5Ch (92) additional bytes of data on this page (excluding this byte).

Vendor Identification – Bytes 08 through 15

The value contained in these bytes is the ASCII representation of "EXABYTE" followed by a single space.

Product Identification – Bytes 16 through 31

The value contained in these bytes is the ASCII representation of the product identifier, "LTO_1x7_2U", followed by six spaces. Each "_" represents an ASCII space character.

Functional Code Level – Bytes 32 through 47

The value contained in these bytes is the ASCII representation of the code level for the functional microcode and the date it was created.

Boot Block Code Level – Bytes 48 through 63

The value contained in these bytes is the ASCII representation of the code level for the boot block microcode and the date it was created.

Internal Self Test Code Level – Bytes 64 through 79

The value contained in these bytes is the ASCII representation of the code level for the internal self test microcode and the date it was created.

Ethernet Card Code Level – Bytes 64 through 79

The value contained in these bytes is the ASCII representation of the code level for the Ethernet module microcode and the date it was created.

6.4 COMMAND STATUS

The autoloader returns a status byte after processing the INQUIRY command. This section describes when each type of status byte might be returned.

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader never returns Busy status for the INQUIRY command.

Reservation Conflict

The autoloader never returns Reservation Conflict status for the INQUIRY command.

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB.
- A reserved bit is set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 6-2 for sense data).

Table 6-2 *Invalid parameters in the INQUIRY CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	24h	00h	1	1	0	0	0002h	Invalid Page Code.
5h	24h	00h	1	1	1	7	0002h	Page value set but EVPD is 0.

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LOG SELECT (4Ch)

Bit Byte	7	6	5	4	3	2	1	0
00	0	1	0	0	1	1	0	0
01	Reserved						PCR	SP
02 … 08	Reserved							
09	0	0	Reserved				0	0

7.1 About This Command

The LOG SELECT command allows you to reset the statistical information maintained by the autoloader to zero. The LOG SELECT command does not transfer any parameters to the autoloader and does not include any parameter pages.

7.2 What You Send to the Autoloader

Byte 01, Bit 1 – PCR (Parameter Code Reset)

This field specifies whether the autoloader should reset all of the parameters or only selected parameters, as follows:

0 – Do not reset any parameters.
1 – Reset all of the parameters.

Note: If you set the PCR bit to 1, be sure that the Parameter List Length is 0. Otherwise, the autoloader will return Check Condition status with the sense key set to Illegal Request (5h), the ASC and ASCQ set to 24h and 00h.

SP (Saved Page) – Byte 01, Bit 0

The autoloader does not support the saved page function. The valid value for this field is 0.

7.3 COMMAND STATUS

The autoloader returns a status byte after processing the LOG SENSE command. This section describes when each type of status byte might be returned.

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 7-1 for sense data).

Table 7-1 *Invalid parameters in the LOG SENSE CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.

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LOG SENSE (4Dh)

Bit / Byte	7	6	5	4	3	2	1	0
00	0	1	0	0	1	1	0	1
01	Reserved						PPC	SP
02	PC		Page Code					
03	Reserved							
04								
05	(MSB) Parameter Pointer							
06								(LSB)
07	(MSB) Allocation Length							
08								(LSB)
09	Reserved							

8.1 About This Command

The LOG SENSE command provides a means for the initiator to retrieve statistics and information on the state of the autoloader. By using this command, you can receive the following information:

- Statistics (for example: retry counts, number of picks and places)
- State of the autoloader hardware
- Element statistics
- Cartridge scan retries
- Element position information
- Last command failure information

8.2 WHAT YOU SEND TO THE AUTOLOADER

PPC (Parameter Pointer Control) – Byte 01, Bit 1

The value for the PPC field must be 0. This directs the autoloader to return the number of bytes that you specify in the Allocation Length field, beginning with the parameter code specified in the Parameter Pointer field (bytes 05 and 06). The autoloader returns the bytes in ascending order of parameter codes from the specified log page. When both the PPC bit and the Parameter Pointer field are set to 0 and the Allocation Length is sufficient, the autoloader returns all available log parameters for the specified log page to the initiator.

SP (Saved Parameters) – Byte 01, Bit 0

The value for this field must be 0, indicating that the autoloader will perform the LOG SENSE command and will not save log parameters.

PC (Page Control) – Byte 02, Bits 6 and 7

This field is always ignored and treated as if it contained the value 01h. This indicates that the autoloader will always return the cumulative values for any log parameter requested. The autoloader does not support any threshold values or default cumulative values.

Page Code – Byte 02, Bits 0 through 5

The Page Code field allows you to identify the page that you want the autoloader to return. The value for this field must be one of the values specified in Table 8-1; otherwise, the autoloader terminates the command with Check Condition status and sets the sense key to Illegal Request with the ASC set to Invalid Field in CDB.

Table 8-1 *Valid values for the Page Code field*

Page Code	Page Name	Description
00h	Supported Log Pages	Returns a list of supported log pages.
2Eh	TapeAlert	Returns information from the autoloader's internal TapeAlert microcode. This microcode constantly monitors the autoloader for errors and potential difficulties. When a problem is detected, the autoloader sets a flag on this page to identify the type of problem detected.
30h	System Statistics	Returns system statistics and retry counts.
33h	Element Statistics	Returns element statistics and retry counts.
34h	Scan Retry	Returns the number of times the autoloader had to retry scanning the cartridge at the specified element address.
36h	Environment	Returns environmental statistics
37h	Command Failure	Returns information on last command failures

Parameter Pointer – Bytes 05 and 06

The Parameter Pointer field allows you to request parameter data by specifying any of the following types of values.

- **A log parameter code.** When you are requesting the Tape Alert page, System Statistics Log page or the Environment page, specify a log parameter code. The autoloader returns the parameter data for that code and all other codes in ascending order until the value specified in the Allocation Length field has been reached or until it completes sending parameter data for the highest code.

Example If you specify 02h for this field in the System Statistics page, the autoloader returns statistics Total Number of Put Retries, Total Number of Scans, and so on, until there are no more statistics or the Allocation Length is exhausted.

- **An element address value.** When you are requesting the Element Statistics Log page, or the Scan Retries page, specify an element address value. The autoloader returns the parameter data for that element and all other elements in ascending element address order until the value specified in the Allocation Length field has been reached or until it completes sending parameter data for the element with the highest element address.

Example If you specify 02h for this field (assuming the element addresses have not been changed), and the Allocation Length is long enough, the autoloader returns statistics for the storage elements (element addresses 02h-07h), the cartridge loader (element address 56h) and the tape drive (element address 52h).

Notes:

- When the Parameter Pointer is 0, the autoloader returns all available log parameters for the specified log page (up to the specified Allocation Length).
- When the Page Code field is set to 00h, the Parameter Pointer field must also be set to 0, indicating that you are requesting the Supported Log Page (00h), which lists all log pages.
- Element addresses may have been changed with the MODE SELECT command.

Allocation Length – Bytes 07 and 08

The Allocation Length field allows you to determine the maximum amount of data to be transferred from the autoloader to the initiator. If you specify an allocation length that is greater than the bytes available, the autoloader terminates the Data In phase when all bytes have been transferred. You can specify 0FFFEh to include all available data.

8.3 WHAT THE AUTOLOADER RETURNS

This section describes the log page structure and the log pages that the autoloader supports. The LOG SENSE command returns a single log page specified in the Page Code field of the CDB. Each log page begins with a four-byte page header (bytes 00 through 03), followed by zero or more variable-length log parameters defined for that page.

Bit / Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code					
01	Reserved							
02	(MSB)		Page Length					
03								(LSB)
04	Log Parameter (First)							
...	...							
n	Log Parameter (Last)							

Page Code – Byte 00, Bits 0 through 5

The Page Code field identifies which log page is being transferred. This field contains one of the codes described in Table 8-1.

Page Length – Bytes 02 and 03

The Page Length field specifies the length, in bytes, of the following Log Parameters. The value returned for this field depends on the value you specified for the Page Code and the Parameter Pointer in the CDB. This value is independent of what you specified for the Allocation Length.

Log Parameters – Bytes 04 through *n*

Log parameters are data structures that are contained in log pages and can be one of the following:

- Data counters that record a count of a particular event
- A numeric value indicating the state of the autoloader hardware
- A string that contains the autoloader event history

The general format of a log parameter is shown on the following section.

8.3.1 LOG PARAMETER FORMAT

Each log parameter begins with a four-byte header followed by one or more bytes of parameter value data.

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB) Parameter Code							
01								(LSB)
02	DU	DS	TSD	ETC	TMC		RSVD	LP
03	Parameter Length							
04	(MSB) Parameter Value							
...								
n								(LSB)

Parameter Code – Bytes 00 and 01

The Parameter Code field identifies which log parameter is being transferred for that log page. The valid values for this field depend on the type of log page the autoloader is returning, as described later in this chapter.

Parameter Control (DU, DS, TSD, ETC, TMC, LP) – Byte 02

The Parameter Control field consists of the following bits:

DU – Disable Update This bit indicates that the autoloader updates the log parameter value to reflect all events that should be recorded by that parameter. This bit is always 0.

DS – Disable Save This bit indicates that the autoloader does not support saving for that log parameter. This bit is always 1.

TSD - Target Save Disable This bit indicates that the autoloader provides a self-defined method for saving log parameters. This bit is always 0.

ETC – Enable Threshold Comparison This bit indicates a comparison to the threshold value is not performed whenever the cumulative value is updated. This bit is always 0.

TMC – Threshold Met Criteria This field defines the basis for comparison of the cumulative and threshold values. This field is always 0.

LP – List Parameter The List Parameter bit indicates the format of the log parameter:

0 – The parameter is a data counter.
1 – The parameter is a list parameter.

Parameter Length – Byte 03

The Parameter Length field specifies the length in bytes of the following Parameter Value field (bytes 04 through *n*).

Parameter Value – Bytes 04 through *n*

The following sections describe all log parameters that the autoloader supports.

8.3.2 SUPPORTED LOG PAGES (PAGE CODE 00h)

The Supported Log Pages page lists all log pages that the autoloader supports. The format for this log page is shown below.

Bit / Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code (00h)					
01	Reserved							
02	(MSB) Page Length (7h)							
03	Page Length (7h) (LSB)							
04	Supported Log Page (00h)							
05	Tape Alert Page (2Eh)							
06	System Statistics Page (30h)							
07	Element Status Page (33h)							
08	Scan Retry Page (34h)							
09	Environmental Page (36h)							
10	Command Failure Page (37h)							

8.3.3 TAPE ALERT PAGE (PAGE CODE 2Eh)

When you issue a LOG SENSE command and request the TapeAlert page, the autoloader returns the Tape Alert parameter codes listed in Table 8-2. Each TapeAlert flag includes four bytes of descriptive information (see page 8-5), followed by a one-byte parameter value for the flag. Bit 0 of the parameter value contains the value for the flag, as follows:

0 – The flag is not currently set.
1 – The flag is currently set.

The remaining 7 bits of the flag are not used.

Notes:

- Issuing a LOG SENSE command to return the TapeAlert page resets all of the flags to 0. The flags are also reset whenever the autoloader is reset or when the condition indicated by the flag is corrected. Undefined flags are always set to 0.
- Although the autoloader only supports the TapeAlert flags listed in Table 8-2, it returns all 64 flags defined in the TapeAlert standard. Unused flags are set to 0.

Table 8-2 *Parameters returned for the LOG SENSE TapeAlert page*

Parameter Code	Flag Name	Type[a]	Description and Corrective Action
01h	Hardware A	C	The autoloader mechanism is having difficulty communicating with the tape drive. 1. Inspect the autoloader to make sure all cable and power connections are secure and tapes inserted correctly. 2. Turn the autoloader off then on. 3. Restart the operation. 4. If the problem persists, contact Exabyte Technical Support (see page iii) or your service provider.
02h	Hardware B	W	There is a problem with the autoloader mechanism. 1. Inspect the autoloader to make sure all connections are secure and tapes inserted correctly. 2. If the problem persists, contact Exabyte Technical Support (see page iii) or your service provider.
03h	Hardware C	C	The autoloader has a hardware fault: 1. Reset the autoloader. See page 3-2 for instructions. 2. Restart the operation. 3. If the problem persists, contact Exabyte Technical Support (see page iii) or your service provider.
04h	Hardware D	C	The autoloader has a hardware fault. 1. Inspect the autoloader to make sure all cable and power connections are secure and tapes inserted correctly. 2. Turn the autoloader off then on. 3. Restart the operation. 4. If the problem persists, contact Exabyte Technical Support (see page iii) or your service provider.
06h	Autoloader Interface	C	The autoloader has a problem with the host interface. 1. Inspect the autoloader to make sure all connections are secure and tapes inserted correctly. 2. Restart the operation. 3. If the problem persists, contact Exabyte Technical Support (see page iii) or your service provider.

Table 8-2 *Parameters returned for the LOG SENSE TapeAlert page (continued)*

Parameter Code	Flag Name	Type[a]	Description and Corrective Action
0Dh	Autoloader Pick Retry	W	There is a potential problem with a drive ejecting cartridges short or with the autoloader mechanism picking a cartridge from a cell. This warning is for information purposes only. No action needs to be taken at this time. 1. Inspect the autoloader to see if any visible problems exist. 2. Insert a cartridge and try the operation again. 3. If the problem persists, contact Exabyte Technical Support (see page iii) or your service provider.
0Eh	Autoloader Place Retry	W	There is a potential problem with the autoloader mechanism placing a cartridge into a cell. This warning is for information purposes only. This warning is for information purposes only. No action needs to be taken at this time. 1. Inspect the autoloader to see if any visible problems exist. 2. Insert a cartridge and try the operation again. If the problem persists, contact Exabyte Technical Support (see page iii) or your service provider.
0Fh	Drive Load Retry	W	There is a potential problem with the robot or drive when placing a cartridge into a drive. This warning is for information purposes only. No action needs to be taken at this time. 1. Inspect the cartridge to verify compatibility. 2. If the problem persists, contact Exabyte Technical Support (see page iii) or your service provider.
10h	Autoloader Door	I	The operation has failed because the cartridge access port door is open. 1. Clear any obstructions from the cartridge access port door. 2. Close the cartridge access port door. 3. If the problem persists, contact Exabyte Technical Support (see page iii) or your service provider. This flag is cleared when the cartridge access port door is closed.
14h	Autoloader Security Mode	I	The security mode of the autoloader has been changed. The autoloader has either been put into secure mode or taken out of secure mode. This is for information only. No action is required.
15h	Autoloader Offline	I	The autoloader has been taken offline or powered off and is unavailable for use.
16h	Autoloader Drive Offline	I	The tape drive inside the autoloader has been taken offline. This is for information purposes only. No action is required.
17h	Autoloader Scan Retry	I	There is a potential problem with the bar code label or the scanner hardware in the cartridge loader. This flag is cleared when the next move command is received.

Table 8-2 *Parameters returned for the LOG SENSE TapeAlert page (continued)*

Parameter Code	Flag Name	Type[a]	Description and Corrective Action
18h	Autoloader Inventory	C	The autoloader has detected an inconsistency in the cartridge inventory. 1. Use the operator panel or issue a INITIALIZE ELEMENT STATUS command to update the cartridge inventory to correct the inconsistency. 2. Restart the operation.
19h	Autoloader Illegal Operation	W	An autoloader operation has been attempted that is invalid at this time.

[a] I = Informational suggestion to user.
W = Warning. Remedial action is advised. Performance of data may be at risk.
C = Critical. Immediate remedial action is required.

8.3.4 SYSTEM STATISTICS PAGE (PAGE CODE 30h)

The System Statistics Log page includes four bytes of descriptive information (see page 8-5) and returns the cumulative autoloader system statistics stored in nonvolatile RAM shown Table 8-3. These values are not reset after power cycles or resets

Table 8-3 *System Statistics (saved in NVRAM)*

Log Parameter Function	Log Parameter Code	Parameter Control Byte						Parameter Length
		DU	DS	TSD	ETC	TMC	LP	
Total Number of Moves	0	0	1	0	0	0	0	4
Total Number of Pick Retries	1	0	1	0	0	0	0	4
Total Number of Put Retries	2	0	1	0	0	0	0	4
Total Number of Scans	3	0	1	0	0	0	0	4
Total Number of Scan Retries	4	0	1	0	0	0	0	4
Total Number of Scan Failures	5	0	1	0	0	0	0	4
Total Number of Door Cycles	6	0	1	0	0	0	0	4
Total Number of Door Retries	7	0	1	0	0	0	0	2
Total Number of Carousel Retries	8	0	1	0	0	0	0	2
Service Required (bit 0)	9	0	1	0	0	0	0	2
Total Drive Load Retries	10 (0Ah)	0	1	0	0	0	0	4

8.3.5 ELEMENT STATISTICS PAGE (PAGE CODE 33h)

The Element Statistics page returns cumulative statistics, such as the total number of puts to the element, the total number of times the autoloader had to retry a put operation to the element, and the total number of times the autoloader had to retry a pick operation to the element. These values are stored in nonvolatile RAM for each element.

The value that you specify for the Parameter Pointer field of the CDB (bytes 05 and 06) determines the value that the autoloader returns in the Parameter Code field of the Element Statistics page. This value specifies the first element (starting Element Address) for which information is returned.

An Element Statistics page is returned for all subsequent elements (in ascending element address order) until the allocation length specified in the CDB has been reached or all element information has been sent. Element addresses can be changed with the MODE SELECT command.

Note: The Parameter Pointer specified in the CDB indicates the starting element address and must be a valid element address for the autoloader.

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB)			Parameter Code (Element Address)				
01								(LSB)
02	0	1	0	0	0	0	0	0
03	Parameter Length (8h)							
04 ... 07	Total Puts							
08	Total Put Retries							
09								
10	Total Pick Retries							
11								

Parameter Code – Bytes 00 and 01

The Parameter Code field indicates the element address for which statistical information is being provided. The element address may have been set by the MODE SELECT command.

Parameter Length – Byte 03

The Parameter Length field indicates the number of bytes that follow this field on the Element Statistics page.

Total Puts – Bytes 04 through 07

The Total Puts field indicates the total number of puts to the element location indicated by the element address. The total number of puts is stored in volatile memory. This value cannot be cleared by a LOG SELECT command with the Parameter Code Reset bit set.

Total Put Retries – Bytes 08 and 09

The Total Put Retries field indicates the total number of times the autoloader had to retry a put operation to the element indicated by the element address. The total number of put retries is stored in nonvolatile memory. This value cannot be cleared by a LOG SELECT command with the Parameter Code Reset bit set.

Total Pick Retries – Bytes 10 and 11

The Total Pick Retries field indicates the number of times the autoloader had to retry a pick operation from the element indicated by the element address. The total number of pick retries is stored in nonvolatile memory. This value cannot be cleared by a LOG SELECT command with the Parameter Code Reset bit set.

8.3.6 CARTRIDGE SCAN RETRIES PAGE (PAGE CODE 34h)

The Cartridge Scan Retries page returns the total number of times the autoloader had to retry scanning the cartridge located in the element. This value is stored in volatile memory for each cartridge and is reset whenever the autoloader is reset, powered-on, or the door is opened. This value can also be cleared by a LOG SELECT command with the Parameter Code Reset bit set.

The value that you specify for the Parameter Pointer field of the CDB (bytes 05 and 06) determines the value that the autoloader returns in the Parameter Code field of the Cartridge Scan Retries page. This value specifies the first element (starting Element Address) for which information is returned.

A Cartridge Scan Retries page is returned for all subsequent elements (in ascending element address order) until the allocation length specified in the CDB has been reached or all element information has been sent. Element addresses can be changed with the MODE SELECT command.

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB)			Parameter Code (Element Address)				
01								(LSB)
02	0	1	0	0	0	0	0	0
03	Parameter Length (2h)							
04	Total Scan Retries							
05								

Parameter Code – Bytes 00 and 01

The Parameter Code field indicates the element address for which statistical information is being provided. The element address is set by the MODE SELECT command.

Parameter Length – Byte 03

The Parameter Length field indicates the number of bytes that follow this field on the Cartridge Scan Retries page.

Total Scan Retries – Bytes 04 and 05

The Total Scan Retries field indicates the total number of times the autoloader had to retry scanning the cartridge that is now located in the element indicated by the element address. Scan retries move with the cartridge and are reset each time the autoloader is reset, powered-on, or when the cartridge access port door is opened.

8.3.7 ENVIRONMENTAL PAGE (PAGE CODE 36h)

The Environmental page returns values describing the environment of the autoloader.

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB)							
01				Parameter Code				(LSB)
02	0	1	0	0	0	0	0	0
03	Parameter Length (1h)							
04	Parameter Value							

Parameter Code – Bytes 00 and 01

The Parameter Code field indicates the environmental parameter for which statistical information is being provided.

Parameter Length – Byte 03

The Parameter Length field indicates the number of bytes that follow this field on the Environmental page.

Parameter Value – Byte 04

Table 8-4 lists the environmental parameters returned on the Environmental page.

Table 8-4 *Parameter codes returned on the LOG SENSE Environmental page*

Parameter Code	Name	Description	Size (Bytes)
8000h	Current Temperature	Current device temperature (degrees Celsius)	1
8001h	Max Temperature	Maximum device temperature this power on (degrees Celsius)	1
8002h	Lifetime Max Temperature	Maximum device temperature for lifetime of drive (degrees Celsius)	1
8003h	Minimum Temperature	Minimum device temperature this power on (degrees Celsius)	1
8004h	Lifetime Minimum Temperature	Minimum device temperature for lifetime of drive (degrees Celsius)	1
8005h	Power Cycles	Number of time device has been powered on	4
8004h	Lifetime Minutes Powered On	Number of minutes the device has been powered on	4

8.3.8 COMMAND FAILURE PAGE (PAGE CODE 37h)

The Command Failure page returns values describing the most recently failed motion command that was issued to the autoloader.

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB)							
01				Parameter Code				(LSB)
02	0	1	0	0	0	0	0	0
03	Parameter Length (8h)							
04	Command							
05	Fault Symptom Code							
06	Command Interface							
07	Physical Element Address							
08	(MSB)							
...				Total Power On Minutes				
11								(LSB)

Parameter Code – Bytes 00 and 01

The Parameter Code field indicates the which command the information on the Command Failure Code page describes. Table 8-5 lists the valid values for the Parameter Code field.

Table 8-5 *Parameter codes returned on the LOG SENSE Command Failure page*

Parameter Code	Name	Description	Size (Bytes)
8000h	Nth Command Failure	Information on last command failure	8
8001h	N-1 Command failure	Information on next to last command failure	8
8002h	N-2 Command Failure	Information on second to last command failure	8
8003h	N-3 Command Failure	Information on third to last command failure	8

Parameter Length – Byte 03

The Parameter Length field indicates the number of bytes that follow this field on the Command Failure Code page.

Command – Byte 04

The Command field indicates name of the failed command. Table 8-6 lists the valid values for the Command field.

Table 8-6 *Command codes returned on the LOG SENSE Command Failure page*

Command Code	Name	Description
00h	None	No command
01h	Initialize	Initialize System
02h	Abort	Abort current command
03h	Self Test	Execute Self Test
04h	Position To Element	Position storage element to drive
05h	Import	Import cartridge
06h	Export	Export Cartridge
07h	Load	Move medium from storage element to data transfer element
08h	Unload	Move medium from data transfer element to storage element
09h	Update Inventory	Update tape inventory
0Ah	Validate Inventory	Validate tape inventory
0Bh	Auto Clean	Load, use, and unload cleaning cartridge from fixed cell location

Fault Symptom Code – Byte 05

The Fault Symptom Code field specifies the reason for the most recent Check Condition status. Table 8-7 lists the valid values for the Fault Symptom Code field.

Table 8-7 *Fault Symptom Codes returned on the LOG SENSE Command Failure page*

Fault Symptom Code	Description
00h	Success (synchronous)
01h	Success (asynchronous)
02h	Service is busy
03h	Operation stopped
04h	Operation aborted
05h	Software error
06h	System error
07h	General hardware failure
08h	SCSI DMA transfer failed
09h	Servo failure
0Ah	Not implemented
0Bh	System time out
0Ch	General failure
0Dh	Drive time out
0Eh	Servo time out
0Fh	SCSI time out
10h	Command parameter error
11h	SCSI parity error
12h	Device is not ready
13h	Drive is too hot
14h	TapeAlert exception
15h	Microcode for download is bad
16h	A Unit Attention Condition exists
17h	Medium removal disallowed
18h	Drive full
19h	Drive empty
1Ah	Drive command error
1Bh	Drive communication error
1Ch	Cell full
1Dh	Cell empty
1Eh	Device is in sequential mode
1Fh	Drive load failed

Table 8-7 *Fault Symptom Codes returned on the LOG SENSE Command Failure page (continued)*

Fault Symptom Code	Description
20h	Drive unload failed
21h	Device Services owned by panel
22h	Device Services owned by E-Net interface
23h	Picker indicates shipping lock in place
24h	Drive interface version not compatible
25h	Cartridge misloaded

Command Interface – Byte 06

The Command Interface field indicates the source of the failed command. Table 8-8 lists the valid values for the Command Interface field.

Table 8-8 *Command Interface codes returned on the LOG SENSE Command Failure page*

Command Interface Code	Description
00h	None
01h	SCSI Command
02h	Panel Command
03h	Ethernet Command
04h	Sequential Mode Command

8.4 COMMAND STATUS

The autoloader returns a status byte after processing the LOG SENSE command. This section describes when each type of status byte might be returned.

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 8-9 for sense data).

Table 8-9 *Invalid parameters in the LOG SENSE CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	24h	00h	1	1	1	0	0000h	The SP field is incorrect. It must be set to 00b.
5h	24h	00h	1	1	1	1	0001h	The PPC field is incorrect. It must be set to 00b.
5h	24h	00h	1	1	1	7	0002h	The PC field is incorrect. It must be set to 01b.
5h	24h	00h	1	1	1	5	0002h	Invalid Page Code.
5h	24h	0h	1	1	0	0	0005h	Invalid parameter pointer.

Notes

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MODE SELECT (15h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	0	1
01	Reserved			PF	Reserved			SP
02	Reserved							
03								
04	Parameter List Length							
05	0	0	Reserved				0	0

9.1 About This Command

The MODE SELECT command enables you to specify operating parameters for the autoloader. These parameters configure the autoloader upon power-up or a reset condition. You provide the parameters in a parameter list that can include the following:

- 4 bytes for the Parameter List Header (required)
- 20 bytes for the Element Address Assignment page
- 6 bytes for the Unique Properties page
- 36 bytes for the LCD Mode page
- 4 bytes for the Cleaning Configuration page

! Important The values sent to the autoloader apply to all initiators in a multi-initiator environment. If an initiator issues a MODE SELECT command that changes any current or saved operating parameters, the autoloader returns a Check Condition status with a sense key of Unit Attention (6h) and an ASC and ASCQ of Mode Parameters Changed (2Ah and 01h, respectively) to all other initiators that issue a request to the autoloader.

Notes:

- Before issuing any MODE SELECT commands, issue a MODE SENSE (1Ah) command with the PC field set to 1h and the Page Code field set to 3Fh to determine which pages of mode parameters are supported, which parameters within the pages are changeable, and the supported length of each page. See Chapter 10 for more information about the MODE SENSE command.
- When you issue a MODE SELECT command, the parameters are not changed until the autoloader has verified that the new values are valid. If any value is not valid, the autoloader returns the appropriate error (see Section 9.3) and does not change the MODE SELECT parameters.

9.2 WHAT YOU SEND TO THE AUTOLOADER

PF (Page Format) – Byte 01, Bit 4

This field specifies the page format used by the autoloader. The autoloader supports the page format specified by SPC-2. This value must be 1.

SP (Saved Page) – Byte 01, Bit 0

The autoloader supports the saved page function. The values for this field are as follows:

0 – Current configuration values are changed to the values sent to the autoloader. Saved values stored in nonvolatile memory are not affected.

1 – Current configuration values specified by this command are saved in nonvolatile memory and are used for subsequent operations.

Parameter List Length – Byte 04

This field indicates the length of the entire parameter list. The parameter list length is equal to the length of one Parameter List Header (4 bytes) plus the lengths of all pages to be transferred. Table 9-1 lists the page lengths. If no pages are to be transferred, specify 0 for the Parameter List Length field.

Note: A parameter list length of 4 is not valid. When you send the Parameter List Header, you must send at least one page with it.

Table 9-1 *MODE SELECT page lengths*

Page	Length (bytes)
Element Address Assignment Page	14h (20)
Unique Properties Page	6h (6)
LCD Mode Page	24h (36)
Cleaning Configuration Page	4h (4)

For example, if you want to transfer the LCD Mode page, set the parameter list length to 40 bytes (28h):

4 bytes	(Parameter List Header length)
+ 36 bytes	(LCD Mode page length)
40 bytes	

If you want to transfer all of the available mode pages, set the parameter list length to 70 (46h):

4 bytes	(Parameter List Header length)
20 bytes	(Element Address Assignment Page)
6 bytes	(Unique Properties Page)
36 bytes	(LCD Mode Page)
+ 4 bytes	(Cleaning Configuration Page)
70 bytes	

9.2.1 PARAMETER LIST HEADER

If you send one or more parameter pages with the MODE SELECT command, you must send a Parameter List Header. Do not send the Parameter List Header if you are not sending any parameter pages.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved							
01								
02								
03								

All fields of the Parameter List Header are reserved. You must specify a value of 0 for each field.

9.2.2 ELEMENT ADDRESS ASSIGNMENT PAGE (PAGE CODE 1Dh)

This section describes the fields for the Element Address Assignment page and the values you can specify for these fields. Refer to Section 2.2 on page 2-2 and to "Assigning Element Addresses" on page 9-4 for an explanation of element addresses.

Assigning Element Addresses

An *element* is a way of classifying various components in the autoloader. Element addresses reference specific physical locations in the autoloader. All of the libraries contains three element types: the cartridge loader, cartridge cells and the tape drive (known as the medium transport, storage, and data transfer elements, respectively). Each element requires an address so that it can be identified during a SCSI command operation. The autoloader has default addresses assigned to each element. Table 9-2 lists the default element address for each element in the autoloader.

Table 9-2 *Default element addresses for each element in the autoloader*

Element	Default Starting Address
First Storage Element	1 (01h)
First Data Transfer Element	82 (52h)
First Medium Transport Element	86 (56h)

If you want to change the addresses of the autoloader's elements, use the Element Address Assignment page. In this page, you assign a starting address for each element type (cartridge loader, cartridge cells, and tape drive) and then specify the total number of elements of that type. Since there is only one cartridge loader and one tape drive, the starting address you specify for these elements is the only address for that element. The element addresses for the cartridge cells are numbered consecutively, with the first address being the starting element address that you specify.

Because the autoloader supports the saved page function, you can save the element address values by setting the SP bit in the CDB to 1. These values configure the autoloader upon power-up or a reset condition.

! Important For the starting element addresses, you can specify any 16-bit binary number, with the following conditions:

- Element addresses must not overlap.
- Addresses for the storage elements must be consecutive. The highest address you can assign for the first storage element is 0FFF9h (1111111111111001b). This causes the last storage element to be numbered 0FFFFh (1111111111111111b).

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code (1Dh)					
01	Page Length							
02	(MSB)		Medium Transport Element Address					
03								(LSB)
04	(MSB)		Number of Medium Transport Elements					
05								(LSB)
06	(MSB)		First Storage Element Address					
07								(LSB)
08	(MSB)		Number of Storage Elements					
09								(LSB)
10	(MSB)		First Import/Export Element Address					
11								(LSB)
12	(MSB)		Number of Import/Export Elements					
13								(LSB)
14	(MSB)		First Data Transfer Element Address					
15								(LSB)
16	(MSB)		Number of Data Transfer Elements					
17								(LSB)
18	Reserved							
19								

Page Code – Byte 00, Bits 5 through 0

This field identifies the Element Address Assignment page. The value of this field must be 1Dh.

Page Length – Byte 01

This field indicates the length, in bytes, of the Element Address Assignment parameter list. The valid value for this field is 12h (18), which indicates that there are an additional 18 bytes of parameter data that follow this byte.

Medium Transport Element Address – Bytes 02 and 03

This field identifies the address of the cartridge loader. The default value for this field is 56h (86).

Number of Medium Transport Elements – Bytes 04 and 05

This field identifies the number of cartridge loaders within the autoloader. The autoloader has only one cartridge loader. The valid value for this field is 1.

First Storage Element Address – Bytes 06 and 07

This field identifies the starting address of the cartridge storage locations. The default starting address is 01h (1). When assigning new addresses, you assign the first number and the autoloader automatically assigns the others sequentially.

Number of Storage Elements – Bytes 08 and 09

This field identifies the maximum number of cartridge storage locations within the autoloader. The maximum valid value for this field is 07h (7).

The number of storage elements is fixed and cannot be changed using the MODE SELECT command. See the *Magnum 1x7 LTO Autoloader Product Manual* for more information about limiting the number of cells used by the autoloader.

Note: If both the Fixed Cleaning Cell and Auto-Clean flags are set to 1 on the Cleaning Configuration Page (see page 9-12) and the InvACIn bit on the Unique Properties Page (see page 9-9) is set to 1, the cell with the highest address may not be available to SCSI. In this case the maximum number of storage elements is six and the value for this field is 06h.

First Import/Export Element Address – Bytes 10 and 11

This field identifies the address of the entry/exit port. The autoloader does not have an entry/exit port. The value for this field must be 0.

Number of Import/Export Elements – Bytes 12 and 13

This field identifies the total number of locations used for importing and exporting cartridges to and from the cartridge storage areas. The autoloader does not have an entry/exit port. The value for this field must be 0.

First Data Transfer Element Address – Bytes 14 and 15

This field identifies the starting address of the installed tape drive. The autoloader has only one tape drive with a default address is 52h (82).

Number of Data Transfer Elements – Bytes 16 and 17

This field identifies the number of tape drive installed in the autoloader. The autoloader has only one tape drive. The valid value for this field is 0 or 1.

Note: The actual number of tape drives installed cannot be changed by this field because the autoloader automatically determines the number of tape drives during power-up. It is not an error to specify a value that is different from the actual number of tape drives installed, as long as that value is 0 or 1. If the value is not 0 or 1, the autoloader returns Check Condition status with the sense key set to Illegal Request.

9.2.3 UNIQUE PROPERTIES PAGE (PAGE CODE 21H)

The Unique Properties Page sets options that are unique to the autoloader.

Bit / Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code (21h)					
01	Page Length (4h)							
02	(MSB) Reserved							
03	Reserved (LSB)							
04	Reserved			MaxStor	RSVD	MaxStorAddr		
05	SOPR	Reserved			InvACln	Dead	RespDuringImmed	

Page Code – Byte 00, Bits 5 through 0

This field identifies the Unique Properties page. The value of this field must be 21h.

Page Length – Byte 01

This field indicates the length, in bytes, of the Unique Properties parameter list. The valid value for this field is 04h (4) which indicates that there are an additional 4 bytes of data that follow this byte.

MaxStor – Byte 4, Bit 4

This field specifies whether the number of available storage elements is limited to the value specified in the MaxStorAddr field, as follows:

0 – Do not limit the number of available storage elements (use all of the cartridge cells as storage elements)

1 – Limit the number of available storage elements to the value specified in the MaxStorAddr field.

The factory default is 0.

The MaxStor field is directly related to the Limit Cells option available from the autoloader's operator panel. The option to limit the number of cells can be set, cleared, or viewed using the operator panel or by issuing a MODE SELECT command with this field set to 1.

This field is kept in nonvolatile RAM, and once set, remains in effect, even between power-on cycles, until changed by this command.

MaxStorAddr – Byte 4, Bits 2 through 0

This field specifies how many storage elements the autoloader reports and uses. Valid values for this field are 1 through 7. The factory default is 7.

This field is kept in nonvolatile RAM, and once set, remains in effect, even between power-on cycles, until changed by this command.

Notes:

- The MaxStorAddr field is directly related to the Limit Cells option available from the autoloader's operator panel. When this field is set, the autoloader only uses the number of cartridge cells specified as storage elements. The unused cells are not available for use as addressable storage elements. The number of cells can be set, cleared, or viewed using the operator panel or by issuing a MODE SELECT command with this field set to the desired number of cells.
- If both the Fixed Cleaning Cell and Auto-Clean flags are set to 1 on the Cleaning Configuration Page (see page 9-12), the highest storage element address indicated by the MaxStorAddr field is used for the cleaning cartridge and is not accessible using SCSI commands.
- The autoloader ignores the MaxStorAddr field if the MaxStor bit is set to 0. If the MaxStorAddr field is set to 7, the autoloader responds as if the MaxStor bit is set to 0.
- Changes to the MaxStorAddr field do not take affect until the autoloader is reset.

SOPR – Byte 05, Bit 7 (SCSI Operating Parameter Restoration)

This field specifies whether the autoloader restores SCSI operating parameters when it detects that microcode has been updated, as follows:

0 – Do not restore SCSI parameters after a microcode update
1 – Restore SCSI parameters after microcode update

The factory default is 0.

Normally the autoloader defaults to power on settings and waits for the host to negotiate. SCSI operating parameters consist of synchronous or asynchronous transfer, wide or narrow transfer, and transfer rate and offset for synchronous transfers.

This field is kept in nonvolatile RAM, and once set, remains in effect, even between power-on cycles, until changed by this command.

InvACln – Byte 05, Bit 3 (Invisible AutoClean Cell)

This field specifies whether the autoloader makes the cell reserved for autocleaning, if any, invisible to the host. When this bit is set, the reserved cell cannot be addressed by any SCSI command. See "FixEnbl – Byte 02, Bit 0" on page 9-12 for additional information about the AutoClean cell.

0 – Do not hide AutoClean reserved cell
1 – Hide AutoClean reserved cell

The factory default is 0.

This field is kept in nonvolatile RAM, and once set, remains in effect, even between power-on cycles, until changed by this command.

Dead – Byte 05, Bit 2 (Dead Device)

This field indicates that the autoloader requires service, as follows:

0 – The autoloader does not require service.
1 – The autoloader requires service.

The factory default is 0.

This bit is normally set during operation if a non-recoverable mechanism error is detected. The field is usually cleared after the problem has been resolved. The field can be set to 1 for diagnostic purposes.

This field is kept in nonvolatile RAM, and once set, remains in effect, even between power-on cycles, until changed by this command.

RespDuringBusy – Byte 05, Bits 1 and 0 (Response During Busy)

This field indicates how the autoloader responds to a motion command received while it is busy completing another motion command (for example, MOVE MEDIUM, INITIALIZE ELEM STATUS). Table 9-3 lists the valid values for this field.

Table 9-3 *Valid values for the RespDuringBusy field in the MODE SELECT Unique Properties page*

RespDuringImmed	Description
00b	A status of BUSY is returned (factory default)
01b	CHECK CONDITION is returned; A REQUEST SENSE command receives an ASC of 04h (Not Ready) and an ASCQ of 01h (Logical Unit Becoming Ready)
10b	The command is queued until the immediate command is complete. A second command receives a BUSY status.
11b	Reserved

This field is kept in nonvolatile RAM, and once set, remains in effect, even between power-on cycles, until changed by this command.

9.2.4 LCD MODE PAGE (PAGE CODE 22h)

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code (22h)					
01	Parameter Length (22h)							
02	LCD Security Valid	LCD Security	Reserved		Write Line 1	Reserved		
03	Reserved							
04 ... 19	Display Line 1							
20 ... 35	Reserved							

Page Code – Byte 00, Bits 5 through 0

This field identifies the LCD Mode page. The value of this field must be 22h.

Parameter Length – Byte 01

This field indicates the length, in bytes, of the LCD Mode page. The valid value for this field is 22h (34), which indicates that 34 bytes of data follow this byte.

LCD Security Valid – Byte 02, Bit 7

This bit indicates whether a change to LCD security is being requested. When LCD security is enabled, access to certain LCD menu options is prevented. The settings for this bit are as follows:

0 – LCD security is not being changed. The value of the LCD Security bit (byte 02, bit 6) should be ignored.

1 – LCD security is being changed according to the value of the LCD Security bit (byte 02, bit 6).

LCD Security – Byte 02, Bit 6

When the LCD Security Valid bit (byte 02, bit 7) is 1, the LCD Security bit enables or disables LCD security. The settings for this bit are as follows:

0 – Disable LCD security (factory default)
1 – Enable LCD security

When LCD security is enabled, access to the following LCD activities is prevented:

- Changing the cartridge loader control mode
- Changing SCSI IDs
- Changing SCSI parity checking
- Changing the emulation mode
- Changing the Ethernet configuration options
- Performing operator panel diagnostics or demo routines
- Using the options for cleaning the tape drive

A user trying to access the operator panel menu options for these activities receives an error message.

Note: You can also enable LCD security from the operator panel using a password. (Refer to the *Magnum 1x7 LTO Autoloader Product Manual* for information.) Whichever method you use to enable LCD security (operator panel or MODE SELECT), you must use the same method to disable LCD security. That is, if you enable LCD security through the operator panel, you must disable it through the operator panel. Similarly, if you enable LCD security using a MODE SELECT command, you must disable it with MODE SELECT.

Write Line 1 – Byte 02, Bit 3

This field determines the type of text that appears on Display Line 1 of the LCD Status Screen (bytes 04 through 23 of the LCD Mode page), as follows:

0 – Autoloader's default text.
1 – Text you specify in bytes 04 through 19 of the LCD Mode page.

Display Line 1 – Bytes 04 through 19

This field enables you to specify the text that will appear on line 1 of the LCD. Display Line 1 is typically used to specify the product name displayed on the LCD. The default product name for the autoloader is "LTO 1x7 2U".

You can use up to 16 characters for this text. If you use less than 16 characters, at least one byte following the text must be a 00h.

The text specified in this field is displayed when the autoloader does not have any active status to display (for example, the cartridge loader is ready to receive commands and there are no error conditions).

9.2.5 CLEANING CONFIGURATION PAGE (PAGE CODE 25h)

The Cleaning Configuration page specifies how the autoloader behaves when it is configured to autoclean the tape drive.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code (25h)					
01	Page Length (02h)							
02	Reserved						Auto	FixEnable
03	Reserved							

Page Code – Byte 00, Bits 5 through 0

This field identifies the Clean Configuration page. The value of this field must be 25h.

Parameter Length – Byte 01

This field indicates the length, in bytes, of the Cleaning Configuration page. The valid value for this field is 02h (2), which indicates that 2 bytes of data follow this byte.

Auto – Byte 02, Bit 1

This bit indicates whether the autoloader will use an available cleaning cartridge to clean the drive automatically when required, as follows:

0 – Do not automatically clean drive.
1 – Automatically clean drive when required if a cleaning cartridge is available.

This bit is ignored if the FixEnbl bit is 0.

FixEnbl – Byte 02, Bit 0

This bit indicates whether the autoloader has a fixed cell reserved for a cleaning cartridge, as follows:

0 – No cleaning cartridge reservation
1 – Highest numbered Storage Element reserved for cleaning cartridge

When the FixEnbl is set to 1, the storage element with the highest element address is reserved for a cleaning cartridge. That storage element is then unavailable for storing a data cartridge. Refer to the *Magnum 1x7 LTO Autoloader Product Manual* more information about the autoloader's Autoclean option.

Notes:

- When both the FixEnbl and the Auto bits are set (that is, when a cell is reserved for a cleaning cartridge and the autoloader is configured to automatically handle cleaning) the cell reserved for the cleaning cartridge, with the highest element address, is removed from the cell geometry.
- The status of reserved cell is not reported in response to the READ ELEMENT STATUS or READ ELEMENT STATUS WITH RANGE commands.
- The reserved element address is invalid for motion commands (for example, MOVE MEDIUM, POSITION TO ELEMENT).
- If the InvACIn bit on the Unique Properties Page (see page 9-9) is set to 1, the valid value for the Number of Storage Elements field on the Element Address Assignment Page (1Dh) for MODE SELECT and MODE SENSE is one less than when there is no Fixed Autoclean cell.
- The handling of the element address reserved for the cleaning cartridge is unchanged on all LOG SELECT and LOG SENSE log pages.
- When a MODE SELECT command changes the values for both the FixEnbl and the Auto bits (either both turned on or both turned off), the autoloader returns NOT READY TO READY Unit Attention (ASC/ASCQ of 28h/00h) message after the successful completion of the command.

9.3 COMMAND STATUS

The autoloader returns a status byte after processing the MODE SELECT command. This section describes when each type of status byte might be returned.

Good

The autoloader returns Good status when it is able to process the command without errors (that is, when the requested MODE SELECT parameters have been copied over the current MODE SELECT settings and, if requested, the saved MODE SELECT settings).

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when the autoloader is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status for the following reasons:

- The autoloader is reserved by a different initiator.
- One or more of the autoloader's elements are reserved by a different initiator and an attempt is made to change any element address.

See Chapter 20 for more information about the RESERVE command.

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 in the CDB.
- The autoloader detects an unrecoverable parity error while receiving the MODE SELECT data.
- A parameter in the CDB on a MODE SELECT page is invalid (see Table 9-4 for sense data).

Table 9-4 *Invalid parameters in the MODE SELECT CDB and mode data*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	1Ah	00h	1	1	0	0	0004h	Invalid Parameter List Length.
5h	21h	01h	1	0	0	0	[a]	Address overlap. The field pointer is set to the value representing the field in the Element Address Assignment page which caused the address overlap, as follows: ▪ 0006h – Medium Transport Element Address ▪ 000Ah – Storage Element Address
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	24h	00h	1	1	1	4h	0001h	Invalid PF (page format). Must be 1.

Table 9-4 *Invalid parameters in the MODE SELECT CDB and mode data (continued)*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	26h	00h	1	0	0	0	[a]	Invalid values in the Parameter List Header. All values must be 0. The value of the field pointer is the value of the first field that contains a non-zero value (00, 01, 02, or 03)
5h	26h	00h	1	0	1	5h	[a]	Invalid Page Code.
5h	26h	00h	1	0	1	7h	[a]	Reserved bits set in the first byte of one of the MODE SELECT pages.
5h	26h	00h	1	0	0	0	[a]	Invalid Parameter Length.
5h	26h	00h	1	0	0	0	[a]	Reserved bits set in the reserved fields 22 or 23 (bytes 18 or 19 of the Element Address Assignment page).
5h	26h	00h	1	0	0	0	[a]	Invalid first import/export address.
5h	26h	00h	1	0	0	0	[a]	Storage element addresses are not consecutive.
5h	26h	00h	1	0	0	0	[a]	Data transfer element addresses are not consecutive.
5h	26h	02h	1	0	0	0	[a]	Address wrap. Number of elements causes the address range to wrap back to 0000.
5h	26h	02h	1	0	0	0	[a]	Invalid number of transport elements.
5h	26h	02h	1	0	0	0	[a]	Invalid number of storage elements.
5h	26h	02h	1	0	0	0	[a]	Invalid number of import/export elements.
5h	26h	02h	1	0	0	0	[a]	Invalid number of data transfer elements.

[a] Field pointer depends on the order in which the pages are sent.

Notes

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MODE SENSE (1Ah)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	0	1	0
01	Reserved				DBD	Reserved		
02	PC		Page Code					
03	Reserved							
04	Allocation Length							
05	Reserved							

10.1 About This Command

The MODE SENSE command enables the autoloader to report its operating mode parameters to the initiator. The initiator can request one or all pages of mode parameters. Each response includes four bytes for the Parameter List Header, followed by the specified number of bytes for each page:

- 20 bytes for the Element Address Assignment page
- 4 bytes for the Transport Geometry Descriptor page
- 20 bytes for the Device Capabilities page
- 6 bytes for the Unique Properties page
- 36 bytes for the LCD Mode page
- 4 bytes for the Cleaning Configuration page
- 4 bytes for the Operating Mode page

Using the MODE SELECT (15h) command, you can change the values of all of these parameters, except the Transport Geometry Descriptor page, the Device Capabilities page, and the Operating Mode page.

10.2 WHAT YOU SEND TO THE AUTOLOADER

DBD (Disable Block Descriptors) – Byte 01, Bit 3

The autoloader ignores this bit.

PC (Page Control) – Byte 02, Bits 7 and 6

This field defines the type of parameters that are to be returned for the MODE SENSE command. Specify one of the following values:

0 (00b) – Current values Indicates that the autoloader should return the current parameter values. The current values returned are:

- The parameters set in the last successful MODE SELECT command.
- The saved values, if a MODE SELECT command has not been executed since the last power-on or reset.
- The default values, if saved values are not available.

1 (01b) – Changeable values Indicates that the autoloader should return the changeable parameter masks. The pages you request are returned and indicate which parameters you can change. All bits of parameters that you can change are set to 1. All bits of parameters that you cannot change are set to 0. The Page Code and Parameter List Length fields contain actual values.

Note: Before issuing a MODE SELECT command, issue a MODE SENSE command with the PC field set to 1 and the Page Code field set to 3Fh. This will allow you to determine the supported pages, the changeable parameters within the pages, and the supported length of each page.

2 (10b) – Default values Indicates that the autoloader should return the default values. The pages you request are returned, with each supported parameter set to its default value. Parameters not supported by the autoloader are set to 0.

3 (11b) – Saved values Indicates that the autoloader should return the saved values. The pages you request are returned, with each supported parameter set to its saved value. Parameters not supported by the autoloader are set to 0.

Note: For a PC value of 3, if no page has been saved, the autoloader returns default values.

Page Code – Byte 02, Bits 5 through 0

This field allows you to specify which page the autoloader should return. Specify one of the following values:

1Dh – Element Address Assignment page
1Eh – Transport Geometry Descriptor page
1Fh – Device Capabilities page
21h – Unique Properties page
22h – LCD Mode page
25h – Cleaning Configuration Page
26h – Operating Mode Page
3Fh – All pages (in the above order)

Allocation Length – Byte 04

This field allows you to specify the length of the parameter list the autoloader will return. The maximum length you need to specify to receive all pages is 98 (62h) bytes. The autoloader terminates the data in phase when the number of bytes specified by the Allocation Length have been transferred or when all available MODE SENSE data have been transferred to the initiator, whichever is less.

10.3 WHAT THE AUTOLOADER RETURNS

This section describes the mode data page structure and the pages that the autoloader supports. The MODE SENSE command returns the single mode data page specified in the Page Code field of the CDB. Each mode data page begins with a four-byte parameter list header, followed by zero or more variable-length mode data parameters defined for the specified page.

10.3.1 PARAMETER LIST HEADER

Bit Byte	7	6	5	4	3	2	1	0
00	Mode Data Length							
01	Reserved							
02								
03								

Mode Data Length – Byte 00

This field indicates the number of bytes of parameter information the autoloader is returning as a result of this command, excluding the Mode Data Length byte, but including the three additional Parameter List Header bytes.

10.3.2 ELEMENT ADDRESS ASSIGNMENT PAGE (PAGE CODE 1Dh)

For the element-specific field definitions in the following list, refer to Figure 2-1 on page 2-3 and to Chapter 9.

Bit Byte	7	6	5	4	3	2	1	0
00	PS	RSVD	Page Code (1Dh)					
01	Parameter Length (12h)							
02	(MSB) Medium Transport Element Address							
03	Medium Transport Element Address (LSB)							
04	(MSB) Number of Medium Transport Elements							
05	Number of Medium Transport Elements (LSB)							
06	(MSB) First Storage Element Address							
07	First Storage Element Address (LSB)							
08	(MSB) Number of Storage Elements							
09	Number of Storage Elements (LSB)							
10	(MSB) First Import/Export Element Address							
11	First Import/Export Element Address (LSB)							
12	(MSB) Number of Import/Export Elements							
13	Number of Import/Export Elements (LSB)							
14	(MSB) First Data Transfer Element Address							
15	First Data Transfer Element Address (LSB)							
16	(MSB) Number of Data Transfer Elements							
17	Number of Data Transfer Elements (LSB)							
18	Reserved							
19	Reserved							

PS (Page Savable) – Byte 00, Bit 7

The value returned for this field is 1, which indicates that the autoloader can save this page to nonvolatile memory.

Page Code – Byte 00, Bits 5 through 0

This field identifies the Element Address Assignment page. The value returned for this field is 1Dh.

Parameter Length – Byte 01

The value returned for this field is 12h (18), which indicates that there are an additional 18 bytes of element address data that follow this byte.

Medium Transport Element Address – Bytes 02 and 03

This field identifies the address of the cartridge loader. The default value for this field is 56h (86).

Number of Medium Transport Elements – Bytes 04 and 05

This field identifies the number of cartridge loaders within the autoloader. The autoloader has only one cartridge loader. The valid value for this field is 1.

First Storage Element Address – Bytes 06 and 07

This field identifies the starting address of the cartridge storage locations. The default starting address is 01h (1). You can change this address with the MODE SELECT (15h) command.

Number of Storage Elements – Bytes 08 and 09

This field identifies the maximum number of cartridge storage locations within the autoloader. The maximum valid value for this field is 07h (7).

The number of storage elements is fixed and cannot be changed using the MODE SELECT command. See the *Magnum 1x7 LTO Autoloader Product Manual* for more information about limiting the number of cells used by the autoloader.

Note: If both the Fixed Cleaning Cell and Auto-Clean flags are set to 1 on the MODE SELECT Cleaning Configuration Page (see page 9-12) and if the InvACIn bit on the MODE SELECT Unique Properties Page (see page 9-9) is set to 1, the cell with the highest address is not be available to SCSI. In this case the maximum number of storage elements is six and the value for this field is 06h.

First Import/Export Element Address – Bytes 10 and 11

This field identifies the address of the entry/exit port. The autoloader does not have an entry/exit port. The value for this field must be 0.

Number of Import/Export Elements – Bytes 12 and 13

This field identifies the total number of locations used for importing and exporting cartridges to and from the cartridge storage areas. The autoloader does not have an entry/exit port. The value for this field must be 0.

First Data Transfer Element Address – Bytes 14 and 15

This field identifies the starting address of the installed tape drive. The default starting address is 52h (82). You can change this address with the MODE SELECT (15h) command.

Number of Data Transfer Elements – Bytes 16 and 17

This field identifies the number of tape drives installed in the autoloader. The autoloader has only one tape drive. The valid value for this field is 0 or 1.

10.3.3 TRANSPORT GEOMETRY DESCRIPTOR PAGE (PAGE CODE 1Eh)

Bit Byte	7	6	5	4	3	2	1	0
00	PS	RSVD	Page Code (1Eh)					
01	Parameter Length (02h)							
02	Reserved							Rotate
03	Member Number in Transport Element Set							

PS (Page Savable) – Byte 00, Bit 7

The value returned for this field is 0, which indicates that the autoloader cannot save this page to nonvolatile memory.

Page Code – Byte 00, Bits 5 through 0

This field identifies the Transport Geometry Descriptor page. The value returned for this field is 1Eh.

Parameter Length – Byte 01

This field indicates the number of additional bytes of transport geometry descriptor data that follow the header. Each descriptor consists of two bytes of information. The autoloader has only one transport mechanism (cartridge loader), so the value returned for this field is 02h.

Rotate – Byte 02, Bit 0

This field indicates the ability of the transport mechanism to handle two-sided media. The autoloader uses only one-sided media, so the value returned for this field is 0.

Member Number in Transport Element Set – Byte 03

This field indicates the specific transport element in the system to which this descriptor is applied. The autoloader has only one transport element, so the value returned for this field is 0.

10.3.4 DEVICE CAPABILITIES PAGE (PAGE CODE 1Fh)

Bit Byte	7	6	5	4	3	2	1	0
00	PS	RSVD	Page Code (1Fh)					
01	Parameter Length (12h)							
02	Reserved				DT 1	I/E 0	ST 1	MT 0
03	Reserved							
04	Reserved				MT→DT 0	MT→I/E 0	MT→ST 0	MT→MT 0
05	Reserved				ST→DT 1	ST→I/E 0	ST→ST 0	ST→MT 0
06	Reserved				I/E→DT 0	I/E→I/E 0	I/E→ST 0	I/E→MT 0
07	Reserved				DT→DT 0	DT→I/E 0	DT→ST 1	DT→MT 0
08 ... 19	Reserved							

PS (Page Savable) – Byte 00, Bit 7

The value returned for this field is 0, which indicates that the autoloader cannot save this page to nonvolatile memory.

Page Code – Byte 00, Bits 5 through 0

This field identifies the page code for the Device Capabilities page. The value returned for this field is 1Fh.

Parameter Length – Byte 01

The Parameter Length is 12h (18), which indicates that there are an additional 18 bytes of device capabilities data that follow this byte.

DT (Data Transfer Element) – Byte 02, Bit 3

The value returned for this field is 1, which indicates that the tape drive can store cartridges. (A cartridge in a tape drive, either loaded or ejected, is considered "stored" in the tape drive.)

I/E (Import/Export Element) – Byte 02, Bit 2

The value returned for this field indicates whether the autoloader has an entry/exit port that can store a data cartridge. The autoloader does not have an entry/exit port. The valid value for this field is 0.

ST (Storage Element) – Byte 02, Bit 1

The value returned for this field is 1, which indicates that the cartridge storage locations can store cartridges.

MT (Media Transport) – Byte 02, Bit 0

The value returned for this field is 0, which indicates that the cartridge loader cannot store cartridges.

MT → DT – Byte 04, Bit 3

The value returned for this field is 0, which indicates that the autoloader does not support the MOVE MEDIUM (A5h) command when the source is the cartridge loader and the destination is the tape drive.

MT → I/E – Byte 04, Bit 2

The value returned for this field is 0, which indicates that the autoloader does not support the MOVE MEDIUM (A5h) command when the source is the cartridge loader and the destination is the entry/exit port element.

MT → ST – Byte 04, Bit 1

The value returned for this field is 0, which indicates that the autoloader does not support the MOVE MEDIUM (A5h) command when the source is the cartridge loader and the destination is a cartridge storage location.

MT → MT – Byte 04, Bit 0

The value returned for this field is 0, which indicates that the autoloader does not support the MOVE MEDIUM (A5h) command when the source is the cartridge loader and the destination is the cartridge loader.

ST → DT – Byte 05, Bit 3

The value returned for this field is 1, which indicates that the autoloader supports the MOVE MEDIUM (A5h) command when the source is a cartridge storage location and the destination is a tape drive.

ST → I/E – Byte 05, Bit 2

The value returned for this field is 0, which indicates that the autoloader does not support the MOVE MEDIUM (A5h) command when the source is a cartridge storage location and the destination is the import/export element.

ST → ST – Byte 05, Bit 1

The value returned for this field is 0, which indicates that the autoloader does not support the MOVE MEDIUM (A5h) command when the source is a cartridge storage location and the destination is a cartridge storage location.

ST → MT – Byte 05, Bit 0

The value returned for this field is 0, which indicates that the autoloader does not support the MOVE MEDIUM (A5h) command when the source is a cartridge storage location and the destination is the cartridge loader.

I/E → DT – Byte 06, Bit 3

The value returned for this field is 0, which indicates that the autoloader does not support the MOVE MEDIUM (A5h) command when the source is the import/export element and the destination is a tape drive.

I/E → I/E – Byte 06, Bit 2

The value returned for this field is 0, which indicates that the autoloader does not support the MOVE MEDIUM (A5h) command when the source is the import/export element and the destination is the import/export element.

I/E → ST – Byte 06, Bit 1

The value returned for this field is 0, which indicates that the autoloader does not support the MOVE MEDIUM (A5h) command when the source is the import/export element and the destination is a cartridge storage location.

I/E → MT – Byte 06, Bit 0

The value returned for this field is 0, which indicates that the autoloader does not support the MOVE MEDIUM (A5h) command when the source is the import/export element and the destination is the cartridge loader.

DT → DT – Byte 07, Bit 3

The value returned for this field is 0, which indicates that the autoloader does not support the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is a tape drive.

DT → I/E – Byte 07, Bit 2

The value returned for this field is 0, which indicates that the autoloader does not support the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is the import/export element.

DT → ST – Byte 07, Bit 1

The value returned for this field is 1, which indicates that the autoloader supports the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is a cartridge storage location.

DT → MT – Byte 07, Bit 0

The value returned for this field is 0, which indicates that the autoloader does not support the MOVE MEDIUM (A5h) command when the source is a tape drive and the destination is the cartridge loader.

10.3.5 UNIQUE PROPERTIES PAGE (PAGE CODE 21h)

The Unique Properties Page provides information about the options for the autoloader that are unique to the autoloader.

Bit / Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code (21h)					
01	Page Length (4h)							
02	(MSB) Reserved							
03	Reserved (LSB)							
04	Reserved			MaxStor	RSVD	MaxStorAddr		
05	SOPR	Reserved			InvACln	Dead	RespDuringImmed	

Page Code – Byte 00, Bits 5 through 0

This field identifies the Unique Properties page. The value of this field must be 21h.

Page Length – Byte 01

This field indicates the length, in bytes, of the Unique Properties parameter list. The valid value for this field is 04h (4) which indicates that there are an additional 4 bytes of data that follow this byte.

MaxStor – Byte 4, Bit 4

This field indicates whether the number of available storage elements is limited to the value specified in the MaxStorAddr field, as follows:

0 – The number of available storage elements is not limited (use all of the cartridge cells as storage elements)

1 – The number of available storage elements is limited to the value indicated in the MaxStorAddr field.

The factory default is 0.

The number of cells reported by the autoloader can be set, cleared, or viewed using the operator panel Limit Cells option or by issuing a MODE SELECT command with the MaxStor field set to 1.

MaxStorAddr – Byte 4, Bits 2 through 0

This field indicates how many storage elements the autoloader reports and uses. Valid values for this field are 1 through 7. The factory default is 7.

The number of cells can be set, cleared, or viewed using the operator panel Limit Cells option or by issuing a MODE SELECT command with the MaxStorAddr field set to the desired number of cells.

SOPR – Byte 05, Bit 7 (SCSI Operating Parameter Restoration)

This field indicates whether the autoloader restores SCSI operating parameters when it detects that microcode has been updated, as follows:

0 – SCSI parameters are not restored after a microcode update
1 – SCSI parameters are restored after a microcode update

The factory default is 0.

This field is kept in nonvolatile RAM, and once set, remains in effect, even between power-on cycles, until changed by the MODE SELECT command.

InvACln – Byte 05, Bit 3 (Invisible AutoClean Cell)

This field indicates whether the autoloader makes the cell reserved for autocleaning, if any, invisible to the host. For all SCSI commands it is as if the cell does not even exist.

0 – AutoClean reserved cell is not hidden
1 – AutoClean reserved cell is hidden

The factory default is 0.

This field is kept in nonvolatile RAM, and once set, remains in effect, even between power-on cycles, until changed by the MODE SELECT command.

Dead – Byte 05, Bit 2 (Dead Device)

This field indicates that the autoloader requires service. This bit is normally set during operation if a non-recoverable mechanism error is detected.

0 – Autoloader does not require service
1 – Autoloader requires service

The factory default is 0.

This field is kept in nonvolatile RAM, and once set, remains in effect, even between power-on cycles, until changed by the MODE SELECT command.

RespDuringBusy – Byte 05, Bits 1 and 0 (Response During Busy)

This field indicates how the autoloader responds to a motion command received while it is busy completing another motion command (for example, MOVE MEDIUM, INITIALZE ELEMENT STATUS). Table 10-1 lists the valid values for this field.

Table 10-1 *Valid values for the RespDuringBusy field in the MODE SENSE Unique Properties page*

RespDuringImmed	Description
00b	A status of BUSY is returned (factory default)
01b	CHECK CONDITION is returned; A REQUEST SENSE command receives an ASC of 04h (Not Ready) and an ASCQ of 01h (Logical Unit Becoming Ready)
10b	The command is queued until the immediate command is complete. A second command receives a BUSY status.
11b	Reserved

This field is kept in nonvolatile RAM, and once set, remains in effect, even between power-on cycles, until changed by the MODE SELECT command.

10.3.6 LCD MODE PAGE (PAGE CODE 22h)

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code (22h)					
01	Parameter Length (22h)							
02	RSVD	LCD Security	Reserved		Write Line 1	Reserved		
03	Reserved							
04 ... 19	Display Line 1							
20 ... 35	Reserved							

Page Code – Byte 00, Bits 5 through 0

This field identifies the LCD Mode page. The value of this field must be 22h.

Parameter Length – Byte 01

This field indicates the length, in bytes, of the LCD Mode page. The valid value for this field is 22h (34), which indicates that 34 bytes of data follow this byte.

LCD Security Valid – Byte 02, Bit 7

This bit indicates whether a change to LCD security is being requested. When LCD security is enabled, access to certain LCD menu options is prevented. The settings for this bit are as follows:

0 – LCD security is not being changed. The value of the LCD Security bit (byte 02, bit 6) should be ignored.

1 – LCD security is being changed according to the value of the LCD Security bit (byte 02, bit 6).

LCD Security – Byte 02, Bit 6

When the LCD Security Valid bit (byte 02, bit 7) is 1, the LCD Security bit enables or disables LCD security. The settings for this bit are as follows:

0 – Disable LCD security (factory default)
1 – Enable LCD security

When LCD security is enabled, access to the following LCD activities is prevented:

- Changing the cartridge loader control mode
- Changing SCSI IDs
- Changing SCSI parity checking
- Changing the emulation mode
- Changing the Ethernet configuration options
- Performing operator panel diagnostics or demo routines
- Using the options for cleaning the tape drive

A user trying to access the operator panel menu options for these activities receives an error message.

Note: You can also enable LCD security from the operator panel using a password. (Refer to the *Magnum 1x7 LTO Autoloader Product Manual* for information.) Whichever method you use to enable LCD security (operator panel or MODE SELECT), you must use the same method to disable LCD security. That is, if you enable LCD security through the operator panel, you must disable it through the operator panel. Similarly, if you enable LCD security using a MODE SELECT command, you must disable it with MODE SELECT.

Write Line 1 – Byte 02, Bit 3

This field indicates the type of text that appears on Display Line 1 of the LCD Status Screen (bytes 04 through 19 of the LCD Mode page), as follows:

0 – Autoloader default text.
1 – Text you specified in bytes 04 through 19 of the MODE SELECT LCD Mode page.

The factory default is 0. You can change this field with the MODE SELECT command (see page 9-10).

Note: The text specified for Display Line 1 is displayed when the autoloader does not have any active status to display (that is, the cartridge loader is ready to receive commands and there are no error conditions).

Display Line 1 – Bytes 04 through 19

This field indicates the text that will appear on line 1 of the LCD. Display Line 1 is typically used to specify the product name displayed on the LCD.

The default product name for the autoloader is "LTO 1x7 2U". You can change this field with the MODE SELECT command (see page 9-10).

10.3.7 CLEANING CONFIGURATION PAGE (PAGE CODE 25h)

The Cleaning Configuration page indicates how the autoloader behaves when it is configured to autoclean the tape drive.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved		Page Code (25h)					
01	Page Length (02h)							
02	Reserved						Auto	FixEnable
03	Cleaning Cartridge Storage Element							

Page Code – Byte 00, Bits 5 through 0

This field identifies the Clean Configuration page. The value of this field must be 25h.

Parameter Length – Byte 01

This field indicates the length, in bytes, of the Cleaning Configuration page. The valid value for this field is 02h (2), which indicates that 2 bytes of data follow this byte.

Auto – Byte 02, Bit 1

This bit indicates whether the autoloader will use an available cleaning cartridge to clean the drive automatically when required, as follows:

0 – Do not automatically clean drive.
1 – Automatically clean drive when required if a cleaning cartridge is available.

This bit is only valid when the FixEnbl bit is 1.

FixEnbl – Byte 02, Bit 0

This bit indicates whether the autoloader has a fixed cell reserved for a cleaning cartridge, as follows:

0 – No cleaning cartridge reservation
1 – Highest numbered Storage Element reserved for cleaning cartridge

When the FixEnbl is set to 1, the storage element with the highest element address is reserved for a cleaning cartridge. That storage element is then unavailable for storing a data cartridge. Refer to the *Magnum 1x7 LTO Autoloader Product Manual* more information about the autoloader's Autoclean option.

Notes:

- When both the FixEnbl and the Auto bits on the Cleaning Configuration Page are set to 1 (that is, when a cell is reserved for a cleaning cartridge and the autoloader is configured to automatically handle cleaning) and if the InvACIn bit on the Unique Properties Page (see page 9-9) is set to 1, the cell reserved for the cleaning cartridge, with the highest element address, is removed from the cell geometry.
- The status of reserved cell is not reported in response to the READ ELEMENT STATUS or READ ELEMENT STATUS WITH RANGE commands.
- The reserved element address is invalid for motion commands (for example, MOVE MEDIUM, POSITION TO ELEMENT).
- The valid value for the Number of Storage Elements field on the Element Address Assignment Page (1Dh) for MODE SELECT and MODE SENSE is one less than when there is no Fixed Autoclean cell.
- The handling of the element address reserved for the cleaning cartridge is unchanged on all LOG SELECT and LOG SENSE log pages.
- When a MODE SELECT command changes the values for both the FixEnbl and the Auto bits (either both turned on or both turned off), the autoloader returns NOT READY TO READY Unit Attention (ASC/ASCQ of 28h/00h) message after the successful completion of the command.

Cleaning Cartridge Storage Element – Byte 3

This field indicates the element address of the storage element that is reserved for a cleaning cartridge. This field is only valid when the FixEnbl bit is 1.

10.3.8 OPERATING MODE PAGE (PAGE CODE 26h)

The Operating Mode page indicates the current operating mode for the autoloader. For more information about operating modes, refer to the *Magnum 1x7 LTO Autoloader Product Manual*.

Bit Byte	7	6	5	4	3	2	1	0
00	PS	RSVD	Page Code (26h)					
01	Page Length (02h)							
02	Reserved						OperMode	
03	Reserved							

PS (Page Savable) – Byte 00, Bit 7

The value returned for this field is 0, which indicates that the autoloader cannot save this page to nonvolatile memory.

Page Code – Byte 00, Bits 5 through 0

This field identifies the Clean Configuration page. The value of this field must be 26h.

Parameter Length – Byte 01

This field indicates the length, in bytes, of the Operating Mode page. The valid value for this field is 02h (2), which indicates that 2 bytes of data follow this byte.

OperMode – Byte 02, Bit 0 - Bit 1

This bit indicates the current operating mode for the autoloader, as follows:

0h – Random mode
1h – Sequential mode
2h – Manual mode (the autoloader is controlled from the operator panel)
3h – Ethernet mode (the autoloader is controlled through the Remote Management utility)

Refer to the *Magnum 1x7 LTO Autoloader Product Manual* for information about Random and Sequential modes.

10.4 COMMAND STATUS

The autoloader returns a status byte after processing the MODE SENSE command. This section describes when each type of status byte might be returned.

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader returns Busy status when the autoloader is processing a command for a different initiator or when the autoloader is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status when the autoloader is reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 10-2 for sense data).

Table 10-2 *Invalid parameters in the MODE SENSE CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	24h	00	1	1	1	3h	0001h	Invalid value in DBD field. Must be 1.
5h	24h	00	1	1	1	5h	0002h	Invalid Page Code.

Notes

11

MOVE MEDIUM (A5h)

Bit Byte	7	6	5	4	3	2	1	0
00	1	0	1	0	0	1	0	1
01	Reserved							
02	(MSB) Transport Element Address							
03								(LSB)
04	(MSB) Source Address							
05								(LSB)
06	(MSB) Destination Address							
07								(LSB)
08	Reserved							
09								
10	Reserved							Invert
11	Reserved							

11.1 About This Command

The MOVE MEDIUM command requests that the cartridge loader move a cartridge from a source element location (address) to a destination element location (address). If the destination is a tape drive, the autoloader will insert the cartridge.

For the valid source element and destination element combinations for the MOVE MEDIUM command, refer to the Device Capabilities page of the MODE SENSE data (see page 10-7).

Note: If you use this command to move a cartridge from a tape drive and the cartridge is still inside the tape drive, the autoloader waits 5 seconds and retries the move operation. If the cartridge is still in the tape drive at that point, the autoloader returns Check Condition status with the sense key set to Illegal Request. The ASC is 3Bh and the ASCQ is 90h, as described in Table 11-5. The 5-second retry allows for the slight delay that can occur after a tape drive indicates that it has unloaded the tape, but before the cartridge is fully unloaded.

11.2 WHAT YOU SEND TO THE AUTOLOADER

Transport Element Address – Bytes 02 and 03

This field is checked for the value set by the MODE SELECT (15h) command. It should contain 0 or the element address of the cartridge loader.

Source Address – Bytes 04 and 05

This field specifies the element address from which the cartridge is to be taken. This can be a storage location or the tape drive.

Destination Address – Byte 06 and 07

This field specifies the element address where the cartridge is to be placed. This can be a storage location or the tape drive.

Invert – Byte 10, Bit 0

The autoloader does not support the Invert function. The valid value for this field is 0.

11.3 EFFECTS ON THE CARTRIDGE INVENTORY

The cartridge inventory is updated after the cartridge loader completes a cartridge move operation, whether or not the cartridge move was successful. The various outcomes of a requested move operation are explained below:

- A cartridge move operation was requested and completed successfully (the source address contained a cartridge, the destination address was empty, and the cartridge was moved). See Table 11-1 for information about how the cartridge inventory is updated.

Table 11-1 *Effect on the cartridge inventory of a successful move operation*

This cartridge inventory field...	...is changed to the following for...	
	...the source address	...the destination address
Occupied	0	1
Occupied Valid	1	1
Label	blanks	copied from source
Label Valid	0	copied from source
Label Scan Retries	0	copied from source
Send Volume Match	0	copied from source
Tape Drive Accessible	1	0
Pick Retries	updated if retried	no change
Put Retries	no change	updated if retried
Total Puts	no change	incremented
Source Address	255	source storage element address

- A cartridge move operation is requested and the cartridge loader finds the source address empty. The autoloader does not attempt to move a cartridge if the cartridge inventory indicates that the source is empty (the Occupied flag is set to 0 and Occupied Valid flag is set to 1). See Table 11-2 for information about how the cartridge inventory is updated.

Table 11-2 *Effect on the cartridge inventory of a move operation when the source is empty*

This cartridge inventory field...	...is changed to the following for...	
	...the source address	...the destination address
Occupied	0	no change
Occupied Valid	1	no change
Label	blanks	no change
Label Valid	0	no change
Label Scan Retries	0	no change
Send Volume Match	0	no change
Tape Drive Accessible	no change	no change
Pick Retries	no change	no change
Put Retries	no change	no change
Total Puts	no change	no change
Source Address	255	no change

- A cartridge move operation is requested and the cartridge loader finds that the destination address contains a cartridge. Table 11-3 describes how the cartridge inventory is updated.

Note: The autoloader does not perform the move operation if the cartridge inventory indicates that the destination is occupied and the Occupied Valid flag is set to 1.

Table 11-3 *Effect on the cartridge inventory of a move operation when the destination is full*

This cartridge inventory field...	...is changed to the following for...	
	...the source address	...the destination address
Occupied	1	1
Occupied Valid	1	1
Label	no change	no change
Label Valid	no change	no change
Label Scan Retries	no change	no change
Send Volume Match	no change	no change

Table 11-3 *Effect on the cartridge inventory of a move operation when the destination is full (continued)*

This cartridge inventory field...	...is changed to the following for...	
	...the source address	...the destination address
Tape Drive Accessible	1	no change
Pick Retries	updated if retried	no change
Put Retries	updated if retried	no change
Total Puts	incremented	no change
Source Address	no change	no change

- A cartridge move operation was requested with the same source and destination address. This type of operation is requested when the occupied status of a location is questionable (the Occupied Valid flag is set to 0). The autoloader does not attempt to move a cartridge if the Occupied Valid flag is set to 1 for the source and destination address and the location is a storage location. Table 11-4 describes how the cartridge inventory is updated.

Table 11-4 *Effect on the cartridge inventory of a move operation when the source and destination are the same*

This cartridge inventory field...	.....is changed to the following when...	
	...the location is empty	...the location is full
Occupied	0	1
Occupied Valid	1	1
Label	blanks	no change
Label Valid	0	no change
Label Scan Retries	0	no change
Send Volume Match	0	no change
Tape Drive Accessible	no change	0
Pick Retries	no change	updated if retried
Put Retries	no change	updated if retried
Total Puts	no change	incremented
Source Address	255	element address

11.4 COMMAND STATUS

The autoloader returns a status byte after processing the MOVE MEDIUM command.

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status when it is reserved by a different initiator or when an element involved in a requested move operation is reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- The autoloader has experienced an unrecoverable hardware error.
- A reserved bit is set to 1 in the CDB.
- The autoloader is not ready because the door is open.
- The information in the cartridge inventory indicates that the requested cartridge move operation cannot be performed.
- After the autoloader attempts to move a cartridge, it finds that the source is empty or the destination is occupied.
- The autoloader encounters a problem while trying to move a cartridge. For example, it encounters a place (put) error while moving a cartridge.

- A parameter in the CDB is invalid (see Table 11-5 for sense data).

Table 11-5 *Invalid parameters in the MOVE MEDIUM CDB and move errors*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
3h	53h	00h	0	0	0	0	0	Media load or eject failed
5h	21h	01h	1	1	0	0	0002h	Invalid transport element address.
5h	21h	01h	1	1	0	0	0004h	Invalid source element address.
5h	21h	01h	1	1	0	0	0006h	Invalid destination element address.
5h	24h	00	1	1	1	0	000Ah	Invalid Invert field.
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	3Bh	0Dh	0	0	0	0	0	Destination element occupied.
5h	3Bh	0Eh	0	0	0	0	0	Source element empty.
5h	3Bh	87h	0	0	0	0	0	Cartridge stuck in tape drive.
5h	3Bh	90h	0	0	0	0	0	Source cartridge is loaded inside the tape drive and is not accessible.
5h	80h	05h	0	0	0	0	0	Source tape drive not installed.
5h	80h	06h	0	0	0	0	0	Destination tape drive not installed.

Notes

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POSITION TO ELEMENT (2Bh)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	1	0	1	0	1	1
01	Reserved							
02	(MSB) Transport Element Address							
03	(LSB)							
04	(MSB) Destination Element Address							
05	(LSB)							
06	Reserved							
07								
08	Reserved							Invert
09	Reserved							

12.1 About This Command

The POSITION TO ELEMENT command allows you to request that the cartridge loader be positioned to a specific element location (address).

The cartridge loader is positioned so that no additional movement is required to access the cartridge at that location for a MOVE MEDIUM (A5h) command. Use this command with an application that may require a pause before issuing a MOVE MEDIUM command. The time that you save with the POSITION TO ELEMENT command is valuable if you would normally have to wait for the cartridge loader to move to the element when you issue the MOVE MEDIUM command.

12.2 WHAT YOU SEND TO THE AUTOLOADER

Transport Element Address – Bytes 02 and 03

This field is checked for the value set by the MODE SELECT (15h) command. It should contain 0 or the element address of the cartridge loader.

Destination Element Address – Bytes 04 and 05

This field allows you to specify the address of the element where the cartridge loader is to be positioned.

Invert – Byte 08, Bit 0

The autoloader does not support the Invert function, so you must specify a value of 0 for this bit.

12.3 COMMAND STATUS

The autoloader returns a status byte after processing the POSITION TO ELEMENT command. This section describes when each type of status byte might be returned.

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status when it or the cartridge loader is reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- The autoloader has experienced an unrecoverable hardware error.

- The autoloader is not ready because the door is open.
- The destination is a tape drive and the tape drive is not installed.
- The autoloader encounters a problem during the position operation.
- A reserved bit is set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 12-1 for sense data).

Table 12-1 *Invalid parameters in POSITION TO ELEMENT CDB and position errors*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	21h	01h	1	1	0	—	0002h	Invalid transport element address.
5h	21h	01h	1	1	0	—	0004h	Invalid destination element address.
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	24h	00h	1	1	1	0	000Ah	Invalid Invert field.
5h	80h	06h	0	0	0	0	0000h	Destination tape drive is not installed.

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PREVENT/ALLOW MEDIUM REMOVAL (1Eh)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	1	1	0
01	Reserved							
02	Reserved							
03								
04	Reserved							Prevent
05	Reserved							

13.1 About This Command

The PREVENT/ALLOW MEDIUM REMOVAL command requests that the autoloader enable or disable access to the cartridge storage area. If at least one initiator has issued this command to prevent cartridge removal, then the cartridge access port door cannot be opened from the operator panel.

13.2 What You Send to the Autoloader

Prevent – Byte 04, Bits 1 and 0

The valid values for this field are as follows:

00b – Allow removal of cartridges through the cartridge access port door.
01b – Prevent removal of cartridges through the cartridge access port door.
10b – Invalid
11b – Invalid

When the Prevent bit is set to 01b, an interlock mechanism on the cartridge access port door activates to prevent the door from being opened until one of the following occurs:

- All initiators that have issued PREVENT MEDIUM REMOVAL commands issue ALLOW MEDIUM REMOVAL commands with the Prevent bit set to 0.
- The autoloader is reset (see Section 3.2 on page 3-2 for information about autoloader resets).

13.3 COMMAND STATUS

The autoloader returns a status byte after processing the PREVENT/ALLOW MEDIUM REMOVAL command. This section describes when each type of status byte might be returned.

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status when it is reserved by a different initiator and a request is made to prevent medium removal. See Chapter 20 for more information about the RESERVE command.

Check Condition

The autoloader returns Check Condition status when:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 in the CDB.

Table 13-1 *Invalid parameters in the PREVENT/ALLOW MEDIUM REMOVAL CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.

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READ BUFFER (3Ch)

Bit / Byte	7	6	5	4	3	2	1	0
00	0	0	1	1	1	1	0	0
01	Reserved					Mode		
02	Buffer ID							
03	(MSB)							
04	Buffer Offset							
05								(LSB)
06	(MSB)							
07	Allocation Length							
08								(LSB)
09	0	0	Reserved				0	0

14.1 About This Command

The READ BUFFER command is used to copy the autoloader's microcode (also known as firmware) or transfer diagnostic data (also known as a *dump*) across the SCSI bus to the initiator.

Note: The READ BUFFER command does not transfer the autoloader's configuration options or the MODE SELECT defaults to the initiator.

14.2 WHAT YOU SEND TO THE AUTOLOADER

Mode – Byte 01, Bits 2 through 0

The Mode field determines the type of operation to be performed. The autoloader supports the following operations:

001b – Vendor Unique operation
010b – Data

Buffer ID – Byte 02

This field determines the type of buffer data to be transferred, as follows:

00h through 07h – Selects the section of the microcode to be copied to the initiator. The Mode field must be set to 001b (Vendor Unique). See Section 14.2.1 for more information about using the READ BUFFER command to copy the autoloader's microcode to the initiator.

80h – Specifies that the autoloader's diagnostic data is to be copied to the initiator. The Mode field must be set to 010b (Data). See Section 14.2.2 for more information about using the READ BUFFER command to copy the autoloader's diagnostic data to the initiator.

Buffer Offset – Bytes 03 through 05

This field specifies the offset into the autoloader memory buffer specified by the Mode field (byte 1, bits 2 through 0), as follows:

- When the Buffer ID is set to a value of 00h through 07h, the valid value for this field is from 000000h through 020000h (0 to 131,072 bytes), minus the Parameter List Length value. If the sum of the Buffer Offset and the Parameter List Length exceeds 020000h, the autoloader returns CHECK CONDITION status.
- When the Buffer ID is set to 80h, the value for this field must be 000000h.

Allocation Length – Bytes 06 through 08

This field specifies the number of bytes to be transferred by the current READ BUFFER command. If the number of bytes specified is larger than the buffer size, only the number of bytes in the buffer will be returned.

- When the Buffer ID is set to a value of 00h through 07h, the Allocation Length determines how many bytes of data the autoloader returns for the current READ BUFFER command (up to 131,072 bytes). By using the Buffer Offset and Allocation Length, you can determine how many READ BUFFER commands are required to return the full EEPROM image. If the sum of the Buffer Offset and the Parameter List Length exceeds 020000h, the autoloader returns CHECK CONDITION status.
- When the Buffer ID is set to 80h, the autoloader returns up to 00FFE0h (65504 bytes) of diagnostic data or the number of bytes specified by the allocation length, whichever is smaller.

14.2.1 USING READ BUFFER TO COPY THE AUTOLOADER MICROCODE TO THE INITIATOR

The autoloader EEPROM has a capacity of 100000h (1,048,576 bytes). This memory is organized into eight sections of 20000h (131,072) bytes each, as follows:

- The first two sections (Buffer IDs 00h and 01h) of the memory (bytes 000000h through 03FFFFh) contain the Boot Block code. This portion of the code is a subset of the autoloader microcode that allows the functional code to be updated even if the functional code currently stored in the autoloader has been so damaged as to make it inoperable.
- The functional code resides in the remainder of the memory (040000h through 0FFFFFh) and is divided into six equal sections, as shown in Figure 14-1:

Table 14-1 *Byte locations of function code sections in the EEPROM*

Buffer ID	Byte location in EEPROM
02h	040000h through 05FFFFh
03h	bytes 060000h through 7FFFFh
04h	bytes 08000h through 9FFFFh
05h	byte 0A000h through BFFFFh
06h	bytes 0C0000h through DFFFFh
07h	bytes 0E0000h through 0FFFFFh

Use one or more READ BUFFER commands to copy a section of the functional microcode to the initiator. Set the Mode field to 1 (Vendor Unique) and the desired Buffer ID (02h through 07h). If you use multiple READ BUFFER commands to transfer a section of the functional code, use the Offset field and the Parameter List Length to specify the offset into the section and the amount of data to be transferred by the command.

14.2.2 USING READ BUFFER TO COPY DIAGNOSTIC DATA TO THE INITIATOR

Use one or more READ BUFFER commands to transfer the autoloader's diagnostic data (also known as Dump Data) to the initiator. The Mode field must be 010b (Data), the Buffer ID must always be 80h, and the Offset field must always be 000000h. The Parameter List Length should be the lesser of 0FFE0h (the maximum size of the diagnostic data) and the largest data transfer the host can perform.

14.3 WHAT THE AUTOLOADER RETURNS

When the Buffer ID is set to 00h through 07h, the autoloader returns the data from the specified section of the microcode as determined by the values in the Offset and Parameter List Length fields.

When the Buffer ID is set to 80h, the autoloader returns the diagnostic data in a proprietary format that can be read by Exabyte Technical Support. The number of bytes returned will be the lesser of the Parameter List Length and the actual length of the dump data.

14.4 EXCEPTIONS AND ERROR CONDITIONS

If a hardware or SCSI bus error occurs while the data is being transferred from the autoloader to the initiator, the autoloader terminates the command and returns Check Condition status. The sense key is set to Aborted Command (Bh). If this occurs, retry the operation.

14.5 COMMAND STATUS

The autoloader returns a status byte after processing the READ BUFFER command. This section describes when each type of status byte might be returned.

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when the autoloader is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status when it is reserved or any of its elements are reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurred while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB or microcode.
- The command was issued to an invalid LUN.

- A Unit Attention condition is pending for the initiator.
- A parameter in the CDB is invalid (see Table 14-2 for sense data).

Table 14-2 *Invalid parameters in the READ BUFFER CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	1Ah	00h	1	1	0	0	0006h	Invalid Parameter List Length.
5h	24h	00h	1	1	0	0	0001h	Invalid Mode value.
5h	24h	00h	1	1	0	0	0002h	Invalid Buffer ID value.
5h	24h	00h	1	1	0	0	0003h	Invalid buffer offset.
5h	24h	00h	1	1	0	0	0006h	Invalid Combination of Buffer Offset and Parameter List Length

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READ ELEMENT STATUS (B8h)

Bit Byte	7	6	5	4	3	2	1	0
00	1	0	1	1	1	0	0	0
01	Reserved			VolTag	Element Type Code			
02	(MSB)	Starting Element Address						
03								(LSB)
04	(MSB)	Number of Elements						
05								(LSB)
06	Reserved						CurData	DVCID
07	(MSB)	Allocation Length						
08								
09								(LSB)
10	Reserved							
11	S/N Req	Reserved					0	0

15.1 About This Command

The READ ELEMENT STATUS command requests that the autoloader return the status of its elements. This command returns the data created as a result of the INITIALIZE ELEMENT STATUS (07h) or INITIALIZE ELEMENT STATUS WITH RANGE (E7h) command. For more information about these commands, see Chapter 4 and Chapter 5.

15.2 WHAT YOU SEND TO THE AUTOLOADER

VolTag – Byte 01, Bit 4

This bit indicates whether you want the autoloader to return volume tag (bar code label) information in response to this command, as follows:

0 – Do not return volume tag (bar code label) information
1 – Return volume tag (bar code label) information

Element Type Code – Byte 01, Bits 3 through 0

This field specifies the particular element types you want the autoloader to report on. The autoloader supports the following Element Type Codes:

0h – All element types
1h – Medium Transport Element (cartridge loader)
2h – Storage Element (cartridge cells)
4h – Data Transfer Element (tape drive)

For an Element Type Code of 0h, the element types are reported in element address order, beginning with the Starting Element Address.

Note: If you specify element type code 3h, the autoloader returns Good status and an Element Status header with all fields set to 00h.

Starting Element Address – Bytes 02 and 03

This field indicates the element address at which to start the transfer of data. Only elements with addresses greater than or equal to the starting address are reported. Element descriptor blocks are not generated for undefined element addresses.

Number of Elements – Bytes 04 and 05

This field specifies the maximum number of element descriptors to be returned. This is an actual number of element descriptors to be returned, not an element address range.

The autoloader returns element descriptors of the requested element type starting with the first element address equal to or greater than the value in the Starting Element Address field.

CURDATA – Byte 06, Bit 1

The CURDATA (current data) bit determines whether the autoloader allows device motion in order to update element status, as follows:

0 – May use motion to confirm device status
1 – May not use motion; must use currently available data

DVCID – Bytes 06, Bit 0

The DVCID (device ID) bit indicates whether the autoloader appends the device identifier for the tape drive, if available, to the standard data transfer element descriptor, as follows:

0 – Do not append the device identifier
1 – Append the device identifier

Allocation Length – Bytes 07 through 09

This field specifies the length in bytes of the space that you are allocating for returned element descriptors. Only complete element descriptors are returned. The autoloader returns element descriptors until *one* of the following conditions is met:

- All available element descriptors have been returned.
- The number of element descriptors specified in the Number of Elements field has been returned.
- The remaining allocation length is smaller than the next complete element descriptor or header to be returned.

S/N Request – Byte 11, Bit 7

This bit indicates whether the autoloader appends the ten-byte tape drive serial number to the standard data transfer element descriptor, as follows:

0 – Do not append the tape drive serial number.
1 – Append the tape drive serial number.

15.3 WHAT THE AUTOLOADER RETURNS

This section describes the Element Status page structure and the element descriptors that the autoloader supports. The Element Status page begins with an eight-byte Element Status Header, followed the requested element descriptors.

15.3.1 ELEMENT STATUS HEADER

This header is returned once for each READ ELEMENT STATUS command received by the autoloader.

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB)			First Element Address Reported				
01								(LSB)
02	(MSB)			Number of Elements Reported				
03								(LSB)
04	Reserved							
05	(MSB)			Byte Count of Report Available				
06								
07								(LSB)

First Element Address Reported – Bytes 00 and 01

This field indicates the smallest element address found that meets the CDB requirements.

Number of Elements Reported – Bytes 02 and 03

This field indicates the total number of elements that meet the CDB requirements. The autoloader returns element descriptors for these elements if you specified a sufficient Allocation Length.

Byte Count of Report Available – Bytes 05 through 07

This field indicates the total number of bytes of element status page data available that meet the CDB requirements. This value is not adjusted to match the value that you specified for the Allocation Length field in the CDB.

15.3.2 ELEMENT STATUS PAGE

The autoloader returns one Element Status page for each group of element descriptors of the same type (that is, it returns one page for each of the following: cartridge loader, cartridge storage locations, and tape drive). The Element Status page is returned only if there is at least one Element Descriptor also being returned.

Bit Byte	7	6	5	4	3	2	1	0
00	Element Type Code							
01	PVolTag	AVolTag	Reserved					
02	(MSB) Element Descriptor Length							
03								(LSB)
04	Reserved							
05	(MSB) Byte Count of Descriptor Data Available							
06								
07								(LSB)

Element Type Code – Byte 00

This field indicates the specific element type (see page 15-2) being reported by the element descriptor.

PVolTag – Byte 01, Bit 7

This field indicates if primary volume tag (bar code label) information is present, as follows:

0 – Volume tag bytes are omitted from the element descriptors
1 – Volume tag information is present

AVolTag – Byte 01, Bit 6

The autoloader does not support alternate volume tags. The value reported for this field is 0.

Element Descriptor Length – Bytes 02 and 03

This field indicates the total number of bytes contained in a single element descriptor, as follows:

- If the descriptor being returned is for either the medium transport element (the cartridge loader) or a storage element (cartridge cell), the length is either 52 bytes (if the VolTag bit is 1) or 16 bytes (if the VolTag bit is 0).

- If the descriptor being returned is for a data transfer element (a tape drive), the element descriptor length changes depending on the setting of the DVCID, VolTag, and S/N Req bits, as shown in Table 15-1.

Table 15-1 *Element descriptor length for the data transfer element*

DVCID	VolTag	S/N Req	Element Descriptor Length (bytes)
0	0	0	24
0	0	1	34
0	1	0	60
0	1	1	70
1	0	0	58
1	0	1	68
1	1	0	94
1	1	1	104

Byte Count of Descriptor Data Available – Bytes 05 through 07

This field indicates the total number of bytes of element descriptor data available for the elements of this element type that meet the CDB requirements. This value is the Element Descriptor Length multiplied by the number of element descriptors. This value is not adjusted to match the value that you specified in the Allocation Length field of the CDB.

15.3.3 ELEMENT DESCRIPTORS

The following sections contain the field definitions for the three types of element descriptors for the autoloader:

- **Medium transport element**: The cartridge loader
- **Storage elements**: The cartridge cells
- **Data transfer element**: The tape drive

Each element descriptor includes the element address and status flags. Each element descriptor can also contain sense code information as well as other information, depending on the element type.

Notes:

- The element descriptors for the elements are very similar, with the exception of a few of the fields. Note the differences in bytes 02, 06, and 07 for the element descriptors.
- The autoloader does not support alternate volume tags. This information is not included in any of the element descriptors.

15.3.4 MEDIUM TRANSPORT ELEMENT DESCRIPTOR

The medium transport element is the cartridge loader. The autoloader contains one cartridge loader, for which it returns the following medium transport element descriptor.

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB)							
01	Element Address							(LSB)
02	Reserved					Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06								
07	Reserved							
08								
09	SValid	Invert	Reserved					
10	(MSB)							
11	Source Storage Element Address							(LSB)
12 ... 47	Primary Volume Tag Information (field omitted if PVolTag = 0)							
48 ... 51	Reserved (field moved up if PVolTag = 0)							

Element Address – Bytes 00 and 01

This field contains the element address of the medium transport element (cartridge loader).

Except – Byte 02, Bit 2

The Except (exception) bit indicates the current state of the cartridge loader, as follows:

0 – The cartridge loader is in a normal state.

1 – The cartridge loader is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.

Full – Byte 02, Bit 0

This field indicates if the cartridge loader contains a cartridge. The possible values for this field are as follows:

0 – The cartridge loader does not contain a cartridge.
1 – The cartridge loader contains a cartridge.

Additional Sense Code (ASC) – Byte 04

If the cartridge loader is in an abnormal state, this field contains the value 83h. Refer to Table 15-3 on page 15-16 for the corresponding ASCQ values and a corrective action for each abnormal state.

Additional Sense Code Qualifier (ASCQ) – Byte 05

The values for this field are listed in Table 15-3 on page 15-16, along with the corrective action to take for each abnormal state.

SValid – Byte 09, Bit 7

The values for this bit indicate the following:

0 – The Source Storage Element Address field (bytes 10 and 11) is invalid.
1 – The Source Storage Element Address field (bytes 10 and 11) is valid.

Invert – Byte 09, Bit 6

The autoloader uses single-sided media and does not support inverting of the media. The information reported for this field is 0.

Source Storage Element Address – Bytes 10 and 11

This field shows the address of the last storage element from which the cartridge was moved.

Primary Volume Tag Information – Bytes 12 through 47

When the PVolTag field (in the Element Status page described on page 15-5) is set to 1, this field contains the volume tag (bar code label) information of the cartridge in the cartridge loader. The autoloader supports only eight bytes of volume tag information, so only the first eight bytes reported are valid.

15.3.5 STORAGE ELEMENT DESCRIPTOR

Each of the autoloader's seven cartridge cells is a storage element. If the autoloader's Limit Number of Cells option is turned on, or if the MaxStor and MaxStorAddr fields are set on the MODE SELECT Unique Properties Page (see page 9-7), the number of storage elements reported is equal to the number of addressable cells specified. See the *Magnum 1x7 LTO Autoloader Product Manual* for more information about changing the number of addressable cells from the LCD.

Note: If both the Fixed Cleaning Cell and Auto-Clean flags are set to 1 on the MODE SELECT Cleaning Configuration Page (see page 9-12) and if the InvACIn bit on the MODE SELECT Unique Properties Page (see page 9-9) is set to 1, the cell with the highest address is not be available to SCSI. In this case the maximum number of storage elements is six.

For each storage element, the autoloader returns the following storage element descriptor.

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB)							
01				Element Address				(LSB)
02	Reserved				Access	Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06								
07	Reserved							
08								
09	SValid	Invert	Reserved					
10	(MSB)							
11				Source Storage Element Address				(LSB)
12 ... 47	Primary Volume Tag Information (field omitted if PVolTag = 0)							
48 ... 51	Reserved (field moved up if PVolTag = 0)							

Element Address – Bytes 00 and 01

This field contains the address of the cartridge storage location (cartridge cell).

Access – Byte 02, Bit 3

This bit indicates whether the cartridge loader can access the cartridge at that location. The storage locations are always accessible. The valid value for this bit is 1.

Except – Byte 02, Bit 2

The Except (exception) bit indicates the current state of the cartridge cell, as follows:

0 – The cartridge cell is in a normal state.

1 – The cartridge cell is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.

Full – Byte 02, Bit 0

This bit indicates whether the cartridge cell contains a cartridge, as follows:

0 – The cell does not contain a cartridge.
1 – The cell contains a cartridge.

Additional Sense Code (ASC) – Byte 04

If the Except bit is set to 1, this field contains the value 83h. Refer to Table 15-3 on page 15-16 for the corresponding ASCQ values and a corrective action for each abnormal state.

Additional Sense Code Qualifier (ASCQ) – Byte 05

The values for this field are listed in Table 15-3 on page 15-16, along with the corrective action to take for each abnormal state.

SValid – Byte 09, Bit 7

The values for this bit indicate the following:

0 – The Source Storage Element Address field (bytes 10 and 11) is invalid.
1 – The Source Storage Element Address field (bytes 10 and 11) is valid.

Invert – Byte 09, Bit 6

The autoloader uses single-sided media and does not support inverting of the media. The value reported for this field is 0.

Source Storage Element Address – Bytes 10 and 11

This field shows the address of the last storage element from which the cartridge was moved.

Primary Volume Tag Information – Bytes 12 through 47

When the PVolTag field (in the Element Status page described on page 15-5) is set to 1, this field contains the volume tag (bar code label) information of the cartridge in the storage location. The autoloader supports eight bytes of volume tag information, so only the first eight bytes reported are valid.

15.3.6 DATA TRANSFER ELEMENT DESCRIPTOR

The autoloader has one data transfer element (tape drive), for which it returns the following data transfer element descriptor.

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB) Element Address							
01								(LSB)
02	Reserved				Access	Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	NotBus	RSVD	IDValid	LUValid	RSVD	Logical Unit Number		
07	SCSI Bus Address							
08	Reserved							
09	SValid	Invert	Reserved					
10	(MSB) Source Storage Element Address							
11								(LSB)
12 ... 47	Primary Volume Tag Information (omitted if PVolTag = 0)							
48	Reserved				Code Set			
49	Reserved				Identifier Type			
50	Reserved							
51	Identifier Length (22h)							
52 ... 85	(MSB) Device Identifier (omitted if DVCID = 0) (field moved up if PVolTag = 0)							(LSB)
86 ... 95	(MSB) Tape Drive Serial Number (omitted if S/N Req = 0) (field moved up if PVolTag = 0)							(LSB)

Element Address – Bytes 00 and 01

This field contains the address of the data transfer element (the tape drive).

Access – Byte 02, Bit 3

This bit indicates whether the cartridge loader can pick or place a cartridge at the tape drive location. The cartridge is accessible if it is ejected from the tape drive. Accessibility is reported as follows:

0 – The tape drive location may not be accessible (a cartridge is loaded in the tape drive, or the tape drive's status is unknown).

1 – The tape drive location is accessible (a cartridge is protruding from the tape drive, or the drive is empty).

Except – Byte 02, Bit 2

The Except (exception) bit indicates the current state of the tape drive, as follows:

0 – The tape drive is in a normal state.

1 – The tape drive is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.

Full – Byte 02, Bit 0

This bit indicates if the tape drive contains a cartridge, as follows:

0 – The tape drive does not contain a cartridge.
1 – The tape drive contains a cartridge.

Additional Sense Code (ASC) – Byte 04

If the tape drive is in an abnormal state, this field contains the value 83h. Refer to Table 15-3 on page 15-16 for the corresponding ASCQ values and a corrective action for each abnormal state.

Additional Sense Code Qualifier (ASCQ) – Byte 05

The values for this field are listed in Table 15-3 on page 15-16, along with the corrective action to take for each abnormal state.

NotBus – Byte 06, Bit 7

This bit indicates whether the tape drive is attached to a medium transport element on a different SCSI bus. Because the tape drive and the cartridge loader are on the same SCSI bus, the valid value for this field is 0.

IDValid – Byte 06, Bit 5

This bit indicates that the SCSI Bus Address field (byte 07) contains valid information as follows:

0 – The SCSI Bus Address field is not valid because a tape drive is not installed at this location.

1 – The SCSI Bus Address field is valid because a tape drive is installed at this location.

LUValid – Byte 06, Bit 4

This bit indicates that the Logical Unit Number field (byte 06, bits 2 through 0) contains valid information as follows:

0 – The Logical Unit Number field is not valid because a tape drive is not installed at this location.

1 – The Logical Unit Number field is valid because a tape drive is installed at this location.

Logical Unit Number – Byte 06, Bits 2 through 0

The value reported for this field is 0.

SCSI Bus Address – Byte 07

The value reported for this field is the tape drive's SCSI ID.

SValid – Byte 09, Bit 7

The values for this bit indicate the following:

0 – The Source Storage Element Address field (bytes 10 and 11) is invalid.
1 – The Source Storage Element Address field (bytes 10 and 11) is valid.

Invert – Byte 09, Bit 6

The autoloader uses single-sided media and does not support inverting the media. The value reported for this bit is 0.

Source Storage Element Address – Bytes 10 and 11

This field shows the address of the last storage element from which the cartridge was moved.

Primary Volume Tag Information – Bytes 12 through 47

When the PVolTag field (in the Element Status page described on page 15-5) is set to 1, the Primary Volume Tag Information field contains the volume tag (bar code label) information of the element being reported by this element descriptor. The autoloader supports eight bytes of volume tag information, so only the first eight bytes reported are valid.

Note: Although the autoloader cannot scan a cartridge loaded in a tape drive, bar code label information can be reported if the cartridge was scanned before it was loaded inside the tape drive. The autoloader obtains this information from the cartridge inventory. Check to see if the Except field (byte 02, bit 2) is set to 1. If it is, the label information reported may be inaccurate because the cartridge inventory is questionable.

Code Set – Byte 48 bits 3 through 0

The value returned for this field is 2h, which indicates that the Device Identifier 1 field (Bytes 52-85) contains ASCII characters. If DVCID is 0, the value for this field is set to 0.

Identifier Type – Byte 49 bits 3 through 0

The value returned for this field is 1h, which indicates that the first eight bytes of the field contain the tape drive's Vendor Identification as returned in the tape drive's Standard Inquiry Data. If DVCID is 0, the value for this field is set to 0.

Identifier Length – Byte 51

The value returned for this field is 22h if DVCID is set to 1, which indicates that the length of the Device Identifier field is 34 (22h) bytes, excluding this byte. If DVCID is 0, the value for this field is set to 0.

Device Identifier – Bytes 52 though 85

This field contains the tape drive's device identifier from the INQUIRY Device Identification page (page code 83h), starting at byte 8, as returned by the tape drive. Refer to the tape drive's documentation for additional information.

Tape Drive Serial Number – Bytes 86 through 95

When either the S/N Req bit (described on page 15-3) is set to 1, the Tape Drive Serial Number field contains the ten-byte tape drive serial number.

If the installed tape drive supports the extended data, the ten-byte tape drive serial number (as received from the tape drive via the serial port) is appended to the standard data transfer element descriptor. If the autoloader receives a READ ELEMENT STATUS command before it has queried the tape drive, this field contains UNKNOWN. If the tape drive does not support returning its serial number to the autoloader, this field contains ten blanks.

15.3.7 ASC AND ASCQ VALUES FOR ABNORMAL STATES

Table 15-2 contains a list of the ASC and ASCQ values that will appear in the Additional Sense Code and Additional Sense Code Qualifier fields of an element descriptor if the element is in an abnormal state. Table 15-2 also indicates the corrective action for each abnormal state. The Except field of an element descriptor indicates if the element is in an abnormal state.

Table 15-2 *ASC and ASCQ values for abnormal element conditions*

ASC	ASCQ	Description	Corrective Action
83h	00h	Label questionable	The bar code label is questionable. Issue an INITIALIZE ELEMENT STATUS (07h) or INITIALIZE ELEMENT STATUS WITH RANGE (E7h) command.
83h	01h	Cannot read bar code label or invalid checksum value	Replace the label as described in the *Magnum 1x7 LTO Autoloader Product Manual*. If the error still occurs and the label is correctly placed, contact your vendor. For specifications for the bar code labels that can be used with the autoloader, refer to the *Exabyte Bar Code Label Specification for LTO Ultrium Cartridges*.
83h	03h	Label and full status questionable	The autoloader was powered on or the cartridge access port door was opened. The cartridge inventory may have been violated. Issue an INITIALIZE ELEMENT STATUS (07h) or INITIALIZE ELEMENT STATUS WITH RANGE (E7h) command. **Note:** If the element is a tape drive that is empty or contains a data cartridge (not ejected), issuing an INITIALIZE ELEMENT STATUS or INITIALIZE ELEMENT STATUS WITH RANGE will not change the questionability of the full status. You may want to issue an UNLOAD command to the tape drive to determine whether the tape drive is full or empty.
83h	04h	Tape drive not installed	There is no tape drive installed. Install a tape drive or ignore the error.
83h	09h	No bar code label	If the cartridge does not have a bar code label, place a label on the cartridge as described in the *Magnum 1x7 LTO Autoloader Product Manual*. If there is a bar code label and it is placed correctly, contact your vendor. For specifications for the bar code labels that can be used with the autoloader, refer to the *Exabyte Bar Code Label Specification for LTO Ultrium Cartridges*.

15.4 COMMAND STATUS

The autoloader returns a status byte after processing the READ ELEMENT STATUS command. This section describes when each type of status byte might be returned.

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- The autoloader is not ready because the door is open.
- A reserved bit is set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 15-3 for sense data).

Table 15-3 *Invalid parameters in the READ ELEMENT STATUS CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	21h	01h	1	1	0	0	0002h	Invalid starting element address.
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	24h	00	1	1	1	3h	0001h	Invalid element type code.

16

RECEIVE DIAGNOSTIC RESULTS (1Ch)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	1	0	0
01	Reserved							
02	Reserved							
03	(MSB)	Allocation Length						
04								(LSB)
05	0	0	Reserved				0	0

16.1 About This Command

You can use the RECEIVE DIAGNOSTIC RESULTS command to retrieve the results of the self-test requested by a previous SEND DIAGNOSTIC (1Dh) command. See Chapter 24 for a description of the self-test.

Note: To ensure that the diagnostic results are up-to-date and accurate, be sure that the RECEIVE DIAGNOSTIC RESULTS command immediately follows the SEND DIAGNOSTIC command and that the tape drive is reserved for the initiator's exclusive use. If there are any intervening commands between the SEND DIAGNOSTIC and the RECEIVE DIAGNOSTIC RESULTS command, the information returned may not be valid.

16.2 WHAT YOU SEND TO THE AUTOLOADER

Bytes 03 and 04 – Allocation Length

This field specifies the number of bytes that the initiator has allocated for the return of RECEIVE DIAGNOSTICS RESULTS data. The autoloader returns only one diagnostic page per command.

Table 16-1 lists the diagnostic pages returned by the RECEIVE DIAGNOSTIC command and their maximum page lengths. Setting the Allocation Length to 0 indicates that no diagnostic data will be returned and is not an error.

Table 16-1 *Maximum page length of each supported RECEIVE DIAGNOSTIC page*

Page Code	Page Name	Maximum Length[a]
00h	Supported Diagnostic Pages page	20h (32 bytes)
F0h	Self Test page	400h (1,024 bytes)
FFh	No Diagnostic Results Available page	04h (4 bytes)

a. This maximum length value includes the four-byte Diagnostic Parameter header sent with each page.

The autoloader terminates the Data In phase when the number of bytes specified in the Allocation Length field has been transferred or when all available data has been transferred to the initiator, whichever is less.

16.3 WHAT THE AUTOLOADER RETURNS

When the autoloader receives a RECEIVE DIAGNOSTIC RESULTS command, it returns the results of the previous SEND DIAGNOSTIC command. Each page of the diagnostic data begins with a four-byte Diagnostic Parameter Header (bytes 00 through 03), followed by the diagnostic parameters for that page. The Diagnostic Parameter Header indicates the page code for the diagnostic parameter data being returned and indicates the total length of the data to follow.

Bit / Byte	7	6	5	4	3	2	1	0
00	Page Code							
01	Reserved							
02	(MSB) Page Length							
03								(LSB)

Byte 00 – Page Code

This field identifies the page code of the diagnostic for which the tape drive is returning data. Table 16-1 lists the valid page codes.

Bytes 02 and 03 – Page Length

This field indicates the total number of bytes that will follow this byte if the Allocation Length specified in the CDB is sufficient. The value returned for this field depends on the value of the Page Code field.

Byte 04 – Diagnostic Parameters

This field contains the data resulting from the diagnostic test indicated by the Page Code field. The data returned for each diagnostic page is described in the following sections.

16.3.1 SUPPORTED DIAGNOSTIC PAGES PAGE (PAGE CODE 00h)

When the value of the Page Code field (byte 00) in the Diagnostic Parameter Header is 00h, the data that follows is the Supported Diagnostic Pages page. This page lists the page codes for all of the diagnostic pages included in the data being returned.

Bit / Byte	7	6	5	4	3	2	1	0
00	Page Code (00h)							
01	Reserved							
02	(MSB) Page Length (0018h)							
03	Page Length (0018h) (LSB)							
04	Supported Diagnostic Pages (Page Code 00h)							
05 ... 26	Exabyte Internal							
27	Self Test (Page Code F0h)							

Page Code – Byte 00

The value returned for this field is 00h, which is the Page Code for the Supported Diagnostics Pages page.

Page Length – Bytes 02 and 03

The value returned for this filed is 0018h, indicating that the autoloader returns an additional 24 bytes of data follow this field.

Supported Log Pages – Byte 04

The value returned for this field is 00h, which indicates support for the Supported Diagnostics Pages page.

Exabyte Internal – Bytes 05 through 26

The page codes listed in the bytes marked "Exabyte Internal" contain proprietary information for use by the autoloader's engineering staff only. No diagnostic data is returned for these pages.

Self Test – Byte 27

The value returned for this field is F0h, which indicates support for the Self Test page.

16.3.2 SELF TEST PAGE (PAGE CODE F0h)

When the value of the Page Code field (byte 00) in the Diagnostic Parameter Header is F0h, the data that follows contains the results from a self-test request issued using the SEND DIAGNOSTIC command or from a previous self-test (or POST), if still available.

Bit / Byte	7	6	5	4	3	2	1	0
00	Page Code (F0h)							
01	Reserved							
02	(MSB)			Page Length (0400h)				
03								(LSB)
04 ... *nn*	Self Test Results							

Page Code – Byte 00

The value returned for this field isF0h, which is the Page Code for the Self Test page.

Page Length – Bytes 02 and 03

The value returned for this filed is always 0400h indicating that the autoloader returns an additional 1,024 bytes of self test data follow this field.

Bytes 4 through *nn* – Self Test Results

The Self Test Results field contains ASCII text that describes the success or failure of the component tests run during the self-test. If the length of the ASCII text is less than 1,024 bytes, the remainder of the field is filled with zeros.

Technical Support may request that you generate this data and send it to them for analysis.

16.3.3 NO DIAGNOSTIC RESULTS AVAILABLE PAGE (PAGE CODE FFh)

When the value of the Page Code field (byte 00) in the Diagnostic Parameter Header is FFh, no additional data follows. The autoloader returns this page if there are no diagnostic results available. The autoloader also returns this page if it has not previously received a SEND DIAGNOSTIC command or if an intervening command has corrupted the diagnostic data.

Bit / Byte	7	6	5	4	3	2	1	0
00	Page Code (FFh)							
01	Reserved							
02	(MSB) Page Length (0000h)							
03	Page Length (0000h) (LSB)							

Page Code – Byte 00

The value returned for this field is FFh, which is the Page Code for the No Diagnostic Results Available Page page.

Page Length – Bytes 02 and 03

The value returned for this filed is always 0000h indicating that there is no diagnostic data to be returned.

16.4 COMMAND STATUS

The autoloader returns a status byte after processing the RECEIVE DIAGNOSTIC RESULTS command. This section describes when each type of status byte might be returned.

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 16-2 for sense data).

Table 16-2 *Invalid parameters in the READ ELEMENT STATUS CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.

17

RELEASE (17h OR 57h)

SIX-BYTE CDB (17h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	1	1
01	Reserved							Element
02	Reservation Identification							
03	(MSB)	Element List Length						
04								(LSB)
05	0	0	Reserved				0	0

TEN-BYTE CDB (57h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	1	0	1	0	1	1	1
01	Reserved			3rdPty	Reserved		LongID	RSVD
02	Reservation Identification							
03	Third Party Device ID							
04 ... 09	Reserved							

17.1 ABOUT THIS COMMAND

The autoloader supports both the six-byte and the ten-byte format of the RELEASE UNIT CDB. The autoloader determines which version of the command is being used based on the operation code in the CDB. You can use either version of the command, depending on which version of the RESERVE command was used, as follows:

- An element reservation must be released using the six-byte RELEASE CDB.
- A 3rd-party reservation must be released using the ten-byte RELEASE CDB.
- A unit reservation may be released using either version of the RELEASE CDB.

The RELEASE command enables you to release reservations of the autoloader or elements of the autoloader that you made with the RESERVE (16h or 56h) command. For information on the RESERVE command, see Chapter 20. For default element addresses for the autoloader, refer to the figure on Figure 2-1 on page 2-3.

Only the initiator that reserved the autoloader or autoloader elements can release the reserved autoloader or elements. If another initiator attempts to release a reserved autoloader or element, the autoloader returns Good status and does not release the autoloader or element.

Releasing a reservation of the autoloader as a unit also releases all element reservations for that initiator.

Releasing an unreserved autoloader or unreserved elements of the autoloader is not an error.

17.2 WHAT YOU SEND TO THE AUTOLOADER

17.2.1 SIX-BYTE CDB (PAGE CODE 17h)

Use the six-byte CDB if you want to release reservations for the autoloader as a unit or specific elements within the autoloader.

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must always be 0.

Element – Byte 01, Bit 0

The valid values for this field are as follows:

0 – Release the autoloader or any reserved elements from reserved status

1 – Release the reserved elements associated with the Reservation Identification (byte 02) from reserved status

Reservation Identification – Byte 02

This field specifies a value established by the initiator to identify the specific reservation request (see Chapter 20). If the Element field (byte 01, bit 0) is 0, this field is ignored.

17.2.2 TEN-BYTE CDB (PAGE CODE 57h)

The ten-byte CDB can only be used to release reservations of the autoloader as a unit or to release a 3rd party reservation. To release reservations of only specified elements, use the six-byte CDB.

Logical Unit Number – Byte 01, Bits 7 through 5

The value for this field must always be 0.

Byte 01, Bit 4 – 3rdPty

This field indicates whether the autoloader is to release a third-party reservation, as follows:

0 – Do not release the third-party reservation.
1 – Release the third-party reservation, but only if the reservation was made using the third-party reservation option by the initiator that is requesting the release for the same SCSI device as specified in the THIRD PARTY DEVICE ID field.

LongID – Byte 01, Bit 1

The value for this field must always be 0, indicating that the autoloader does not support device IDs greater than 255.

Element – Byte 01, Bit 0

Element reservations are not supported in the 10-byte RELEASE CDB. The value for this field must always be 0. Use the 6-byte RELEASE CDB to release element reservations.

Reservation Identification – Byte 02

Element reservations are not supported in the 10-byte RELEASE CDB. The autoloader ignores this field. Use the 6-byte RELEASE CDB to release element reservations.

Byte 03 – Third Party Device ID

This field indicates the SCSI ID of the initiator that reserved the autoloader. The autoloader ignores this field if the initiator is not requesting a third-party reservation release.

17.3 COMMAND STATUS

The autoloader returns a status byte after processing the RELEASE command. This section describes when each type of status byte might be returned.

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The autoloader never returns Reservation Conflict status for the RELEASE command.

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 17-1 for sense data).

Table 17-1 *Invalid parameters in the RELEASE CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	24h	00	1	1	1	1h	0001h	LongID field is set to 1.
5h	24h	00	1	1	1	1h	0000h	Element field is set to 1.

18

REQUEST SENSE (03h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	1	1
01	Reserved							
02	Reserved							
03								
04	Allocation Length							
05	0	0	Reserved				0	0

18.1 About This Command

The REQUEST SENSE command requests that the autoloader transfer sense data to the initiator. The autoloader provides sense data in only the Error Code 70h, extended sense data format. The autoloader returns a total of 20 bytes of sense data to the initiator.

The sense data is constructed and saved on a per-initiator and requested LUN basis. The autoloader preserves sense data for all initiators until the data is retrieved by the REQUEST SENSE command or until the autoloader receives any other command for the same I_T_L nexus (initiator-target-LUN connection).

Sense data is available under the following circumstances:

- The previous command to the specified I_T_L nexus terminated with Check Condition status.
- The previous command to the specified I_T_L nexus terminated with an unexpected bus free error.

- The REQUEST SENSE command was issued to an unsupported LUN. In this case, the autoloader does not return Check Condition status and returns the following sense data:

Sense key	Illegal Request (5h)
ASC	Logical unit not supported (25h)
ASCQ	00h

If no sense data is available for the specified I_T_L nexus, the autoloader returns the following sense data:

Sense key	No Sense (0h)
ASC	No additional sense information (00h)
ASCQ	00h

18.2 WHAT YOU SEND TO THE AUTOLOADER

Allocation Length – Byte 04

This field indicates the number of bytes that the initiator has allocated for returned sense data. The autoloader provides a total of 14h (20) bytes of sense data.

18.3 WHAT THE AUTOLOADER RETURNS

The autoloader returns the standard extended sense bytes, as described below.

Bit Byte	7	6	5	4	3	2	1	0
00	RSVD	1	1	1	0	0	0	0
01	00h							
02	0	0	0	RSVD	Sense Key			
03 ... 06	(MSB) Information Bytes (LSB)							
07	Additional Sense Length							
08 ... 11	(MSB) Command Specific Information (LSB)							
12	Additional Sense Code (ASC)							
13	Additional Sense Code Qualifier (ASCQ)							
14	Field Replaceable Unit Code							
15	SKSV	(MSB) Sense Key Specific						
16		Sense Key Specific						
17		Sense Key Specific (LSB)						
18	Fault Symptom Code (FSC)							
19	FSC Command							

Sense Key – Byte 02, Bits 3 through 0

Table 18-1 contains descriptions of the sense key values supported by the autoloader.

Table 18-1 *Sense key descriptions*

Hex Value	Sense Key	Description
0h	No Sense	Indicates that there is no specific sense key information to be reported for the autoloader.
2h	Not Ready	Indicates that the autoloader is not ready to perform cartridge loader motion commands.

Table 18-1 *Sense key descriptions (continued)*

Hex Value	Sense Key	Description
3h	Medium Error	Indicates that the command terminated with a non-recovered error condition that was probably caused by a flaw in the medium or an error in the recorded data. This sense key may also be returned if the autoloader is unable to distinguish between a flaw in the medium and a specific hardware error (sense key 4h).
4h	Hardware Error	Indicates that the autoloader detected a hardware failure while performing the command or during a self-test. Operator intervention may be required.
5h	Illegal Request	Indicates that there was an illegal parameter in the command descriptor block or in the additional parameters supplied as data for a command, or the autoloader is in the wrong mode to execute the command.
6h	Unit Attention	Indicates that the cartridge inventory may have been violated.
Bh	Aborted Command	Indicates that the autoloader aborted the command. The initiator may be able to recover by trying the command again.

Information Bytes – Bytes 03 through 06

The autoloader does not support this sense field and returns 0.

Additional Sense Length – Byte 07

This byte indicates the total number of sense bytes that follow this byte. The value returned is 0Ch (12 bytes).

Command Specific Information – Bytes 08 through 11

This field is not supported by the autoloader. The value returned is 0.

Additional Sense Code (ASC) – Byte 12

This field, together with the Additional Sense Code Qualifier (byte 13), denotes a specific error condition. For a list of these error conditions, refer to Appendix A.

Additional Sense Code Qualifier (ASCQ) – Byte 13

This field, together with the Additional Sense Code (byte 12), denotes a specific error condition.

Field Replaceable Unit Code – Byte 14

This field is not supported by the autoloader. The value returned is 0.

SKSV (Sense Key Specific Valid) – Byte 15, Bit 7

When this bit is set to 1, the information in the Sense Key Specific field is valid. The SKSV field can be set to 1 only for a sense key of Illegal Request (5h).

Sense Key Specific – Byte 15, Bits 6 through 0; Bytes 16 and 17

When the SKSV bit is set to 1, the information contained in this field indicates which field in the CDB or parameter list of a command caused the Check Condition status. This field, valid only for a sense key of Illegal Request (5h), is defined as follows:

Bit Byte	7	6	5	4	3	2	1	0
15	SKSV	C/D	Reserved		BPV	Bit Pointer		
16	(MSB)	Field Pointers						
17								(LSB)

C/D (Command/Data) – Byte 15, Bit 6 Indicates whether the Check Condition status resulted from an illegal parameter in either the command descriptor block (Command) or the parameter list (Data) of a particular command, as follows:

0 – The Check Condition status resulted from an illegal parameter in the parameter list (Data).

1 – The Check Condition status resulted from an illegal parameter in the command descriptor block (Command).

BPV (Bit Pointer Valid) – Byte 15, Bit 3 Indicates whether the value in the Bit Pointer field is valid, as follows:

0 – The value contained in the Bit Pointer is not valid.
1 – The value contained in the Bit Pointer (byte 15, bits 2 through 0) is valid.

The value in the Bit Pointer field is valid when the field of the CDB or parameter list that caused the error is less than one byte long.

Bit Pointer – Byte 15, Bits 2 through 0 Specifies the bit of the byte identified by the Field Pointer (bytes 16 and 17). When a multiple-bit field is in error, the Bit Pointer contains the value of the most significant bit of the field. The most significant bit of a multiple-bit field is the bit with the highest bit number. For example, if a field consists of bits 5, 4, and 3, the most significant bit is bit 5.

Field Pointer – Bytes 16 and 17 Contains the number of the byte in which the error occurred. Byte numbers start at 00. When a multiple-byte field is in error, the Field Pointer contains the value of the most significant byte of the field. The most significant byte of a multiple-byte field is the byte with the lowest byte number. For example, if a field consists of bytes 02, 03, and 04, the most significant byte is byte 02.

18.3.1 PRIORITIES OF SENSE BYTES

Multiple errors may occur during the processing of a single SCSI command. The sense key reflects the last error that occurred. For example, if a message error occurs after an unrecoverable hardware error, the autoloader handles the errors in the following manner:

- The message error is reported.
- The hardware error is preserved, and the next motion command issued by any host terminates with Check Condition status.
- A subsequent REQUEST SENSE command reports the hardware error.

18.3.2 SENSE BYTE PENDING STATUS

When the autoloader reports Check Condition status in response to a command from an initiator, the autoloader retains the sense byte pending status, including error information and Check Condition status for the initiator, until one of the following occurs:

- Error information is reset by the next command execution for the same initiator.
- Error information is reset by a reset or power-on condition.

18.4 COMMAND STATUS

The autoloader returns a status byte after processing the REQUEST SENSE command. This section describes when each type of status byte might be returned.

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader never returns Busy status for the REQUEST SENSE command.

Reservation Conflict

The autoloader never returns Reservation Conflict status for the REQUEST SENSE command.

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB.
- A reserved bit is set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 18-2 for sense data).

Table 18-2 *Invalid parameters in the READ ELEMENT STATUS CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.

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REQUEST VOLUME ELEMENT ADDRESS (B5h)

Bit Byte	7	6	5	4	3	2	1	0
00	1	0	1	1	0	1	0	1
01	Reserved			VolTag	Element Type Code			
02	(MSB) Starting Element Address							
03	(LSB)							
04	(MSB) Number of Elements							
05	(LSB)							
06	Reserved							
07	(MSB) Allocation Length							
08								
09	(LSB)							
10	Reserved							
11	0	0	Reserved				0	0

19.1 ABOUT THIS COMMAND

The REQUEST VOLUME ELEMENT ADDRESS command requests that the autoloader return the element descriptors created as a result of the SEND VOLUME TAG (B6h) command. Data is returned in element address order. For information about the SEND VOLUME TAG command, see Chapter 23.

Note: In a multi-initiator environment, you should reserve the entire autoloader using the RESERVE (16h or 56h) command before you request element descriptors. Do not issue the RELEASE (17h or 57h) command until after you have successfully obtained data with the REQUEST VOLUME ELEMENT ADDRESS command. You should issue commands in the following order:

1. RESERVE (16h) for the entire autoloader
2. SEND VOLUME TAG (B6h)
3. REQUEST VOLUME ELEMENT ADDRESS (B5h)
4. RELEASE (17h)

19.2 WHAT YOU SEND TO THE AUTOLOADER

VolTag – Byte 01, Bit 4

This field indicates whether you want the autoloader to return the volume tag (bar code label) information searched for by the SEND VOLUME TAG (B6h) command. Volume tag information is obtained when the autoloader scans the bar code label affixed to each cartridge in the autoloader. The valid values for this field are as follows:

0 – Do not report volume tag information
1 – Report volume tag information

Note: For specifications for the bar code labels that can be used with the autoloader, refer to the *Exabyte Bar Code Specification for LTO Ultrium Cartridges*.

Element Type Code – Byte 01, Bits 3 through 0

This field specifies the element types you want the autoloader to report on. The autoloader supports the following Element Type Codes:

0h – All element types
1h – Medium transport element (the carousel/cartridge loader)
2h – Storage element (the seven cartridge cells)
4h – Data transfer elements (the tape drive)

For an Element Type Code of 0h, the element types are reported in element address order, beginning with the address specified in the Starting Element Address field.

Note: If you specify element type code 3h, the autoloader returns Good status and an Element Status header with all fields set to 00h.

Starting Element Address – Bytes 02 and 03

This field indicates the element address at which to start the transfer of data. Only elements with addresses greater than or equal to the starting address are reported. Element descriptor blocks are not generated for undefined element addresses.

Number of Elements – Bytes 04 and 05

This field represents the actual number of element descriptors to be returned. This is an actual number of element descriptors to be returned, not an element address range.

The autoloader returns element descriptors of the requested element type, starting with the first element address equal to or greater than the value in the Element Address field. All element descriptors are returned for the number of element descriptors specified in this field, or the number of element descriptors available, whichever is less.

It is not an error to specify 0FFFFh as a value for this field if you want the autoloader to return all available elements.

Allocation Length – Bytes 07 through 09

The Allocation Length specifies the total available length in bytes you are allocating for returned element descriptors. Only complete element descriptors are returned. The autoloader returns element descriptors until *one* of the following conditions is met:

- All available element descriptors have been returned.
- The number of element descriptors specified in the Number of Elements field has been returned.
- The remaining allocation length is smaller than the next complete element descriptor or header to be returned.

19.3 WHAT THE AUTOLOADER RETURNS

19.3.1 VOLUME ELEMENT ADDRESS HEADER

The autoloader returns one Volume Element Address Header for each REQUEST VOLUME ELEMENT ADDRESS command that it receives.

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB) First Element Address Reported							
01								(LSB)
02	(MSB) Number of Elements Reported							
03								(LSB)
04	Reserved			Send Action Code				
05	(MSB) Byte Count of Report Available							
06								
07								(LSB)

First Element Address Reported – Bytes 00 and 01

This field indicates the address of the first element that has a bar code label that matches the template sent by the SEND VOLUME TAG (B6h) command.

Number of Elements Reported – Bytes 02 and 03

This field indicates the total number of element descriptors available to be transferred to the initiator. The status of these elements is returned if a sufficient Allocation Length value was specified in the CDB.

Send Action Code – Byte 04, Bits 4 through 0

This field contains the action code in the SEND VOLUME TAG command that created the data. The autoloader supports a Send Action Code of 5h.

Byte Count of Report Available – Bytes 05 through 07

This field indicates the total number of bytes of information available to be transferred to the initiator. This value is not adjusted to match the Allocation Length.

19.3.2 ELEMENT STATUS PAGE

The autoloader returns one Element Status page for each group of element descriptors of the same type.

Bit Byte	7	6	5	4	3	2	1	0
00	Element Type Code							
01	PVolTag	AVolTag	Reserved					
02	(MSB) Element Descriptor Length							
03	(LSB)							
04	Reserved							
05	(MSB) Byte Count of Descriptor Data Available							
06								
07	(LSB)							

Element Type Code – Byte 00

This field indicates the specific element type (see page 19-2) being reported by the element descriptor.

PVolTag – Byte 01, Bit 7

This field indicates if primary volume tag (bar code label) information is present, as follows:

0 – Volume tag bytes are omitted from the element descriptors
1 – Volume tag information is present

AVolTag – Byte 01, Bit 6

The autoloader does not support alternate volume tags. The value reported for this field is 0.

Element Descriptor Length – Bytes 02 and 03

This field indicates the total number of bytes contained in a single element descriptor, as follows:

- If the descriptor being returned is for either the medium transport element (the cartridge loader) or a storage element (cartridge cell), the length is either 52 bytes (if the VolTag bit is 1) or 16 bytes (if the VolTag bit is 0).

- If the descriptor being returned is for a data transfer element (a tape drive), the element descriptor length changes depending on the setting of the DVCID, VolTag, and S/N Req bits, as shown in Table 19-1.

Table 19-1 *Element descriptor length for the data transfer element*

DVCID	VolTag	S/N Req	Element Descriptor Length (bytes)
0	0	0	24
0	0	1	34
0	1	0	60
0	1	1	70
1	0	0	58
1	0	1	68
1	1	0	94
1	1	1	104

Byte Count of Descriptor Data Available – Bytes 05 through 07

This field indicates the total number of bytes of element descriptor data available for the elements of this element type that meet the CDB requirements. This value is not adjusted to match the value that you specified for the Allocation Length field. This value is the Element Descriptor Length multiplied by the number of element descriptors.

19.3.3 ELEMENT DESCRIPTORS

The following sections contain the field definitions for the types of elements in the autoloader:

- **Medium transport element:** The cartridge loader
- **Storage elements:** The cartridge cells
- **Data transfer element:** The tape drive

Each element descriptor includes the element address and status flags. Each element descriptor may also contain sense code information as well as other information, depending on the element type.

Notes:

- The element descriptors for the types of elements are very similar, with the exception of a few of the fields. Note the differences in bytes 06 and 07.
- The autoloader does not support alternate volume tags. This information is not included in any of the element descriptors.

19.3.4 MEDIUM TRANSPORT ELEMENT DESCRIPTOR

The medium transport element is the cartridge loader. The autoloader contains one cartridge loader.

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB) Element Address							
01								(LSB)
02	Reserved					Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	Reserved							
07								
08								
09	SValid	Invert	Reserved					
10	(MSB) Source Storage Element Address							
11								(LSB)
12 ... 47	Primary Volume Tag Information (field omitted if PVolTag = 0)							
48 ... 51	Reserved (field moved up if PVolTag = 0)							

Element Address – Bytes 00 and 01

This field contains the element address of the medium transport element (cartridge loader).

Except – Byte 02, Bit 2

The Except (exception) bit indicates the current state of the cartridge loader, as follows:

0 – The cartridge loader is in a normal state.

1 – The cartridge loader is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.

Full – Byte 02, Bit 0

This field indicates whether the cartridge loader contains a cartridge. Since no match could have been made if there were no cartridge present, the value for this field is always 1.

Additional Sense Code (ASC) – Byte 04

If the cartridge loader is in an abnormal state, this field contains the value 83h. Refer to Table 19-2 for the corresponding ASCQ values and a corrective action for each abnormal state.

Additional Sense Code Qualifier (ASCQ) – Byte 05

The values for this field are listed in Table 19-2, along with the corrective action to take for each abnormal state.

SValid – Byte 09, Bit 7

This bit is set as follows:

0 – The Source Storage Element Address field (bytes 10 and 11) is invalid.
1 – The Source Storage Element Address field (bytes 10 and 11) is valid.

Invert – Byte 09, Bit 6

The autoloader uses single-sided media and does not support inverting of the media. The information reported for this field is 0.

Source Storage Element Address – Bytes 10 and 11

This field shows the address of the last element from which the cartridge was moved.

Primary Volume Tag Information – Bytes 12 through 47

When the PVolTag field (in the Element Status page described on page 19-5) is set to 1, this field contains the volume tag (bar code label) information of the cartridge in the cartridge loader. The autoloader supports eight bytes of volume tag information, so only the first eight bytes reported are valid.

19.3.5 STORAGE ELEMENT DESCRIPTOR

Each of the autoloader's seven cartridge cells is a storage element. If the autoloader's Limit Number of Cells option is turned on, or if the MaxStor and MaxStorAddr fields are set on the MODE SELECT Unique Properties Page (see page 9-7), the number of storage elements reported is equal to the number of addressable cells specified. See the *Magnum 1x7 LTO Autoloader Product Manual* for more information about changing the number of addressable cells from the LCD.

Note: If both the Fixed Cleaning Cell and Auto-Clean flags are set to 1 on the MODE SELECT Cleaning Configuration Page (see page 9-12) and if the InvACIn bit on the MODE SELECT Unique Properties Page (see page 9-9) is set to 1, the cell with the highest address is not be available to SCSI. In this case the maximum number of storage elements is six.

For each storage element, the autoloader returns the following storage element descriptor.

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB)							
01				Element Address				(LSB)
02	Reserved				Access	Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06								
07	Reserved							
08								
09	SValid	Invert	Reserved					
10	(MSB)							
11				Source Storage Element Address				(LSB)
12 ... 47	Primary Volume Tag Information (field omitted if PVolTag = 0)							
48 ... 51	Reserved (field moved up if PVolTag = 0)							

Element Address – Bytes 00 and 01

This field contains the element address of the storage element (cartridge storage cell).

Access – Byte 02, Bit 3

This bit indicates whether the cartridge loader can access the cartridge. The cartridge storage location is always accessible. The valid value for this bit is 1.

Except – Byte 02, Bit 2

The Except (exception) bit indicates the current state of the cartridge cell, as follows:

0 – The cartridge cell is in a normal state.

1 – The cartridge cell is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.

Full – Byte 02, Bit 0

This bit indicates whether the cell contains a cartridge. Since no match could have been made if there was no cartridge present, the value for this bit is always 1.

Additional Sense Code (ASC) – Byte 04

If the cell is in an abnormal state, this field contains the value 83h. Refer to Table 19-2 for the corresponding ASCQ values and a corrective action for each abnormal state.

Additional Sense Code Qualifier (ASCQ) – Byte 05

The values for this field are listed in Table 19-2, along with the corrective action to take for each abnormal state.

SValid – Byte 09, Bit 7

This bit is set as follows:

0 – The Source Storage Element Address field (bytes 10 and 11) is invalid.
1 – The Source Storage Element Address field (bytes 10 and 11) is valid.

Invert – Byte 09, Bit 6

The autoloader uses single-sided media and does not support inverting of the media (recording on both sides of the tape). The value reported for this bit is 0.

Source Storage Element Address – Bytes 10 and 11

This field shows the address of the last storage element from which the cartridge was moved.

Primary Volume Tag Information – Bytes 12 through 47

When the PVolTag field (in the Element Status page described on page 19-5) is set to 1, this field contains the volume tag (bar code label) information of the cartridge in this storage location. The autoloader supports eight bytes of volume tag information, so only the first eight bytes reported are valid.

19.3.6 DATA TRANSFER ELEMENT DESCRIPTOR

The autoloader has one data transfer element (the tape drive), for which it returns the following data transfer element descriptor.

Bit Byte	7	6	5	4	3	2	1	0
00	(MSB)							
01	Element Address							(LSB)
02	Reserved				Access	Except	RSVD	Full
03	Reserved							
04	Additional Sense Code							
05	Additional Sense Code Qualifier							
06	NotBus	RSVD	IDValid	LUValid	RSVD	Logical Unit Number		
07	SCSI Bus Address							
08	Reserved							
09	SValid	Invert	Reserved					
10	(MSB)							
11	Source Storage Element Address							(LSB)
12 ... 47	Primary Volume Tag Information (omitted if PVolTag = 0)							
48 ... 51	Reserved (field moved up if PVolTag = 0)							

Element Address – Bytes 00 and 01

This field contains the address of the data transfer element (the tape drive).

Access – Byte 02, Bit 3

This bit indicates whether the cartridge loader can pick or place a cartridge at the tape drive location. The cartridge is accessible if it is unloaded from the tape drive at that location. Accessibility is reported as follows:

0 – The tape drive location may not be accessible (a cartridge was last reported in the tape drive but is not currently unloaded).

1 – The tape drive location is accessible (a cartridge is unloaded and waiting to be picked, or the tape drive is empty).

Except – Byte 02, Bit 2

The Except (exception) bit indicates the current state of the tape drive, as follows:

0 – The tape drive is in a normal state.

1 – The tape drive is in an abnormal state and the Additional Sense Code and the Additional Sense Code Qualifier fields contain information regarding the abnormal state.

Full – Byte 02, Bit 0

This bit indicates if the tape drive contains a cartridge. Since a match could have been made only if there was a cartridge present, the value for this bit is always 1.

Additional Sense Code (ASC) – Byte 04

If the tape drive is in an abnormal state, this field contains the value 83h. Refer to Table 19-2 for the corresponding ASCQ values and a corrective action for each abnormal state.

Additional Sense Code Qualifier (ASCQ) – Byte 05

The values for this field are listed in Table 19-2, along with the corrective action to take for each abnormal state.

NotBus – Byte 06, Bit 7

This bit indicates whether the tape drive is attached to a medium transport element on a different SCSI bus. Because the tape drive and the cartridge loader are on the same SCSI bus, the valid value for this field is 0.

IDValid – Byte 06, Bit 5

This bit indicates that the SCSI Bus Address field (byte 07) contains valid information as follows:

0 – The SCSI Bus Address field is not valid because a tape drive is not installed at this location.

1 – The SCSI Bus Address field is valid because a tape drive is installed at this location.

LUValid – Byte 06, Bit 4

This bit indicates that the Logical Unit Number field (byte 06, bits 2 through 0) contains valid information as follows:

0 – The Logical Unit Number field is not valid because a tape drive is not installed at this location.

1 – The Logical Unit Number field is valid because a tape drive is installed at this location.

Logical Unit Number – Byte 06, Bits 2 through 0

The value reported for this field is 0.

SCSI Bus Address – Byte 07

The value reported for this field is the tape drive's SCSI ID.

SValid – Byte 09, Bit 7

This bit is set as follows:

0 – The Source Storage Element Address field (bytes 10 and 11) is invalid.
1 – The Source Storage Element Address field (bytes 10 and 11) is valid.

Invert – Byte 09, Bit 6

The autoloader uses single-sided media and does not support inverting of the media (recording on both sides of the tape). The value reported for this bit is 0.

Source Storage Element Address – Bytes 10 and 11

This field shows the addresses of the last storage element from which the cartridge was moved.

Primary Volume Tag Information – Bytes 12 through 47

When the PVolTag field (in the Element Status page described in page 19-5) is set to 1, the Primary Volume Tag Information field contains the volume tag information of the cartridge in this tape drive. The autoloader supports eight bytes of volume tag information, so only the first eight bytes reported are valid.

Note: Although the autoloader cannot scan a cartridge loaded in a tape drive, bar code label information can be reported if the cartridge was scanned before it was loaded inside the tape drive. The autoloader obtains this information from the cartridge inventory. Check to see if the Except field (byte 02, bit 2) is set to 1. If it is, the label information reported may be inaccurate because the cartridge inventory is questionable.

19.3.7 ASC AND ASCQ VALUES FOR ABNORMAL STATES

Table 19-2 contains a list of the ASC and ASCQ values that appear in the Additional Sense Code and Additional Sense Code Qualifier fields of an element descriptor if the element is in an abnormal state. Table 19-2 also indicates the corrective action for each abnormal state. The Except field of an element descriptor indicates if the element is in an abnormal state.

Table 19-2 *ASC and ASCQ values for abnormal element conditions*

ASC	ASCQ	Description	Corrective Action
83h	00h	Label questionable	▪ The bar code label is questionable. Issue an INITIALIZE ELEMENT STATUS (07h or E7h) command to reread the label. ▪ Replace the label. Refer to the *Magnum 1x7 LTO Autoloader Product Manual* for information about placing the labels on the cartridges.For specifications for the bar code labels that can be used with the autoloader, refer to the *Exabyte Bar Code Specification for LTO Ultrium Cartridges*. ▪ If the error persists, contact your service provider.
83h	01h	Cannot read bar code label	▪ Replace the label. Refer to the *Magnum 1x7 LTO Autoloader Product Manual* for information about placing the labels on the cartridges.For specifications for the bar code labels that can be used with the autoloader, refer to the *Exabyte Bar Code Specification for LTO Ultrium Cartridges*. ▪ If the error persists and the label is properly placed, contact your service provider.
83h	03h	Label and full status questionable	The autoloader was powered on or the cartridge access port door was opened. The cartridge inventory may have been violated. Issue an INITIALIZE ELEMENT STATUS (07h or E7h) command to reestablish the cartridge inventory.
83h	09h	No bar code label	▪ If the cartridge does not have a bar code label, place a label on the cartridge. Refer to the *Magnum 1x7 LTO Autoloader Product Manual* for information about placing the labels on the cartridges.For specifications for the bar code labels that can be used with the autoloader, refer to the *Exabyte Bar Code Specification for LTO Ultrium Cartridges*. ▪ If error persists and a label is present and properly placed, contact your service provider.

19.4 COMMAND STATUS

The autoloader returns a status byte after processing the REQUEST VOLUME ELEMENT ADDRESS command. This section describes when each type of status byte might be returned.

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- A reserved bit is set to 1 in the CDB.
- The autoloader is not ready because the door is open or the autoloader is operating in LCD mode or Console mode.
- A parameter in the CDB is invalid (see Table 19-3 for sense data).

Table 19-3 *Invalid parameters in the REQUEST VOLUME ELEMENT ADDRESS CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	21h	01h	1	1	0	0	0002h	Invalid starting element address.
5h	24h	00h	1	1	1	3h	0001h	Invalid element type code.

Notes

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RESERVE (16h OR 56h)

SIX-BYTE CDB (16h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	1	0
01	Reserved							Element
02	Reservation Identification							
03	(MSB)	Element List Length						
04								(LSB)
05	0	0	Reserved				0	0

TEN-BYTE CDB (56h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	0	1	1	0
01	Reserved							Element
02	Reservation Identification							
03	Third Party Device ID							
04 ... 06	Reserved							
07	(MSB)	Parameter List Length						
08								(LSB)
09	0	0	Reserved				0	0

20.1 ABOUT THIS COMMAND

The RESERVE command allows the initiator to perform two types of reservations:

- Unit reservation — reserves the autoloader as a whole.
- Element reservation — reserves specific elements of the autoloader, including storage elements (the cartridge cells) and the tape drive.

The autoloader supports both the six-byte and the ten-byte format of the RESERVE UNIT CDB. The autoloader determines which version of the command is being used based on the operation code in the CDB. You can use either version of the command, with the following qualifications:

- Individual elements can only be reserved using the six-byte RESERVE CDB.
- A 3rd-party reservation can only be made using the ten-byte RESERVE CDB.
- Either version of the RESERVE CDB can be used to reserve the autoloader as a unit.

Reservations can be released with a RELEASE (17h or 57h) command from the same initiator (see Section 17.1 on page 17-2), a reset, or a power-on of the autoloader.

To modify or supersede a previous element reservation, issue a RESERVE command with the same Reservation Identification. If the superseding reservation does not result in any reservation conflicts or error conditions, the autoloader releases the previous reservation and completes the new reservations. A unit reservation of the autoloader will supersede any previous element reservations by the same initiator.

Notes:

- If the autoloader is reserved as a unit, the autoloader processes only the following commands from another initiator:
  - INQUIRY
  - RELEASE
  - REQUEST SENSE
  - PREVENT/ALLOW MEDIUM REMOVAL with Prevent=00b

  All other commands result in a Reservation Conflict (18h) status.
- If an initiator has reserved at least one element, another initiator cannot do the following:
  - Issue a MODE SELECT command that changes any element addresses. If the autoloader receives such a command, it returns a Reservation Conflict (18h) status to the initiator.
  - Move a cartridge to or from that element.
  - Position the cartridge loader to that element.
  - Issue a WRITE BUFFER command to load new flash code.

- If an initiator has reserved the cartridge loader, the autoloader returns Reservation Conflict (18h) status to the following commands from another initiator:
  - INITIALIZE ELEMENT STATUS
  - INITIALIZE ELEMENT STATUS WITH RANGE
  - MOVE MEDIUM
  - POSITION TO ELEMENT
  - SEND DIAGNOSTICS (except Page Code 00h, Supported pages)

20.2 WHAT YOU SEND TO THE AUTOLOADER

20.2.1 SIX-BYTE CDB (PAGE CODE 16h)

Use the six-byte CDB if you want to reserve the autoloader as a unit or specific elements within the autoloader.

Element – Byte 01, Bit 0

This field specifies whether you are reserving the entire autoloader or a series of autoloader elements, as follows:

0 – Reserve the entire autoloader.

1 – Reserve a series of elements, identified by the Reservation Identification field (byte 02) and specified by the Element List Descriptor.

Reservation Identification – Byte 02

This field allows you to assign an identification number to a reservation request that reserves a series of elements. You can assign any one-byte number you want. You can use this number with the RELEASE (17h) command to release the same series of elements (see Chapter 17 for more information).

Element List Length – Bytes 03 and 04

This field specifies the total length in bytes of the element list descriptors that you are sending. Each element list descriptor is 6 bytes, so the valid values for this field are 0, 6, and increments of 6.

The maximum value for this field is 36h (54 =9 x 6), where 9 is the maximum number of elements and 6 is the number of bytes required for each element list descriptor

If the Element field (byte 01, bit 0) is 0, this field is ignored.

If the Element field (byte 01, bit 0) is 1 and the value for the Element List Length field is 0, no elements are reserved.

20.2.2 ELEMENT LIST DESCRIPTOR

After sending the RESERVE CDB, you send zero or more Element List Descriptors to reserve specific autoloader elements.

Bit Byte	7	6	5	4	3	2	1	0
00	Reserved							
01								
02	(MSB) Number of Elements							
03								(LSB)
04	(MSB) Element Address							
05								(LSB)

Number of Elements – Bytes 02 and 03

This field allows you to specify the number of elements to be reserved. If you specify 0 for this field, all elements starting at the Element Address (bytes 04 and 05) through the last element address for the autoloader are reserved.

Element Address – Bytes 04 and 05

This field allows you to specify the element or the starting address of a series of elements to be reserved. See Figure 2-1 on page 2-3 for the default element addresses for the autoloader.

20.2.3 TEN-BYTE CDB (PAGE CODE 56h)

The ten-byte CDB can only be used to reserve the autoloader as a unit. To reserve only specified elements, use the six-byte CDB.

LongID – Byte 01, Bit 1

The value for this field must always be 0, indicating that the autoloader does not support device IDs greater than 255.

Element – Byte 01, Bit 0

Element reservations are not supported in the 10-byte RESERVE CDB. The value for this field must always be 0. Use the 6-byte RESERVE CDB to reserve specific elements within the autoloader.

Reservation Identification – Byte 02

Element reservations are not supported in the 10-byte RESERVE CDB. The autoloader ignores this field. Use the 6-byte RESERVE CDB to reserve specific elements within the autoloader.

Byte 03 – Third Party Device ID

This field indicates the SCSI ID of the device for which the initiator is making the third-party reservation. The autoloader ignores this field if the initiator is not requesting a third-party reservation (the 3rdPty bit is set to 0).

Parameter List Length – Byte 07 and 08

Long ID and element reservation are not supported for this command, so value for this field must always be zero.

20.3 COMMAND STATUS

The autoloader returns a status byte after processing the RESERVE command. This section describes when each type of status byte might be returned.

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status when:

- The autoloader is reserved by a different initiator.
- An initiator attempts to reserve an element that is reserved by a different initiator.
- An initiator attempts to reserve an element it has already reserved under a different Reservation Identification.

If an element address has already been reserved by another initiator, none of the requested elements is reserved, Reservation Conflict (18h) status is returned to the initiator, and the sense key is set to No Sense (0h).

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving either the CDB or the element descriptor data.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.

- A reserved bit is set to 1 in the CDB.
- A parameter in the CDB or element descriptor data is invalid (see Table 20-1 for sense data).

Table 20-1 *Invalid parameters in the RESERVE CDB and element descriptor data*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	1Ah	00h	1	1	0	0	0003h	Invalid Element List Length.
5h	24h	00h	1	1	1	3h	0001h	Error in Third Party Device field.
5h	24h	00h	1	1	1	4h	0001h	Error in 3rdPty field.
5h	26h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	26h	00h	1	0	0	0	0000h[a]	Reserved field not 0.
5h	26h	00h	1	0	0	0	0001h[a]	Reserved field not 0.
5h	26h	02h	1	0	0	0	—[b]	Overlapped element address in element list descriptor.
5h	26h	02h	1	0	0	0	0004h[a]	Invalid element address.
5h	26h	02h	1	1	0	0	0002h[a]	Element reservation attempted when LUN is already reserved by this initiator.

[a] You can send more than one Element List Descriptor at a time. Add six to this field pointer value for each subsequent descriptor.

[b] The Field Pointer depends on the number of element descriptors sent.

21

REZERO UNIT (01h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	0	1
01	Reserved							
02								
03								
04								
05								

21.1 About This Command

The REZERO UNIT command is implemented to provide software compatibility when it is required. Because the autoloader does not need to calibrate its mechanics, it always returns an immediate Good status in response to this command.

21.2 Command Status

The autoloader returns a status byte after processing the REZERO UNIT command. This section describes when each type of status byte might be returned.

Good

The autoloader always returns Good for this command.

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB or the parameter list.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- The autoloader is not ready because the door is open.
- A reserved bit is set to 1 in the CDB.

22

SEND DIAGNOSTIC (1Dh)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	1	1	1	0	1
01	Reserved			PF	RSVD	SelfTest	DevOfl	UnitOfl
02	Reserved							
03	Parameter List Length							
04								
05	0	0	Reserved				0	0

22.1 About This Command

The SEND DIAGNOSTIC command causes the autoloader to perform its diagnostic self-test. If a test is successful, the autoloader returns Good status; otherwise, it returns Check Condition status. When this command is followed by a RECEIVE DIAGNOSTIC RESULTS (1Ch) command or a REQUEST SENSE (03h) command, the results of the self-test are reported to the initiator.

Notes:

- To ensure that the diagnostic data returned is valid, the SEND DIAGNOSTIC command must be immediately followed by the RECEIVE DIAGNOSTIC RESULTS command.
- To ensure that the results of the diagnostic test are not destroyed by a command sent by another initiator, the autoloader should be reserved for the initiator's exclusive use.
- The initiator must support the disconnect option if you plan to use the SEND DIAGNOSTIC command because the autoloader will disconnect from the initiator while the command is executing.

22.2 WHAT YOU SEND TO THE AUTOLOADER

Byte 01, Bit 4 – PF (Page Format)

This field specifies whether the format of the parameter list for the SEND DIAGNOSTIC command conforms to the page format defined in the SCSI standard, as follows:

0 – The parameter list uses non-page format. This value is only valid if the SelfTest bit (byte 01, bit 2) is set.

1 – The parameter list uses the SCSI page format. This value is valid for all pages.

Byte 01, Bit 2 – SelfTest

This bit specifies whether the autoloader should perform its default diagnostic self-test, as follows:

0 – Perform the diagnostic tests specified in the Parameter List.

1 – Preform the default diagnostic self-test. The Parameter List Length must be 0.

Byte 01, Bit 1 – DevOffL

This bit specifies whether the autoloader is allowed to perform diagnostic tests whose results may be detected by subsequent I/O processes (for example unit reservations, log parameters, or sense data), as follows:

0 – The autoloader may not perform diagnostic tests whose results may be detected by subsequent I/O processes.

1 – The autoloader may perform diagnostic tests whose results may be detected by subsequent I/O processes.

Byte 01, Bit 0 – UnitOffL

This field specifies whether the autoloader is allowed to perform diagnostic tests that might affect the tape, such as writing data or repositioning the tape, as follows:

0 – The autoloader may not perform diagnostic test that might affect the tape.
1 – The autoloader may perform diagnostic test that affect the tape.

Bytes 03 and 04 – Parameter List Length

The value for this field specifies the number of bytes of data that follow in the parameter list. The additional data is one of the diagnostic pages described in the following sections. Table 22-1 lists the diagnostic pages supported by the tape drive and the maximum page length of each.

Table 22-1 *Maximum page length of each supported SEND DIAGNOSTIC page*

Page Code	Page Name	Page Length[a]
00h	Supported Diagnostic Pages page	0000h (0 bytes)
F0h	Self Test page	0000h (0 bytes)

[a] Maximum page length does not include the four-byte Diagnostic Parameter Header, which must be included with each page.

22.3 ADDITIONAL DIAGNOSTIC DATA

Following each SEND DIAGNOSTIC CDB is a parameter list for the Diagnostic page you are sending. The parameter list for each diagnostic page begins with a four-byte Diagnostic Parameter Header (bytes 00 through 03), followed by the parameters for that page. The Diagnostic Parameter Header indicates the page code for the diagnostic page and indicates the total length of the parameter list to follow.

Bit / Byte	7	6	5	4	3	2	1	0
00	Page Code							
01	Reserved							
02	(MSB) Page Length							
03								(LSB)

Byte 00 – Page Code

This field identifies the page code of the diagnostic page being sent. Table 22-1 lists the page codes for all of the supported diagnostic pages.

Bytes 02 and 03 – Page Length

This field indicates the total number of bytes that will follow this byte. The valid value for this field depends on the value in the Page Code field. Table 22-1 lists of the page length for each of the supported diagnostic pages.

22.3.1 SUPPORTED DIAGNOSTIC PAGES PAGE (PAGE CODE 00h)

When the value of the Page Code field (byte 00) in the Diagnostic Parameter Header is 00h, the data that follows contains parameters for the Supported Diagnostic Pages page. This page allows the initiator to retrieve the list of supported pages using the RECEIVE DIAGNOSTIC RESULTS command. The value in the Page Length field (bytes 2 and 3) of the Diagnostic Parameter Header for this page is 0000h, indicating that there are no parameters associated with this diagnostic page.

Bit / Byte	7	6	5	4	3	2	1	0
00	Page Code (00h)							
01	Reserved							
02	(MSB) Page Length (0000h)							
03								(LSB)

22.3.2 SELF TEST PAGE (PAGE CODE F0h)

When the value of the Page Code field (byte 00) in the Diagnostic Parameter Header is F0h, the Self Test page is executed by the SEND DIAGNOSTIC command. The value in the Page Length field (bytes 2 and 3) of the Diagnostic Parameter Header is 0000h, indicating that there are no parameters associated with this diagnostic page. This diagnostic page has the same effect as setting the SelfTest bit (byte 1, bit 2) in the CDB.

Bit / Byte	7	6	5	4	3	2	1	0
00	Page Code (F0h)							
01	Reserved							
02	(MSB) Page Length (0000h)							
03								(LSB)

22.4 COMMAND STATUS

The autoloader returns a status byte after processing the SEND DIAGNOSTIC command. This section describes when each type of status byte might be returned.

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status when it is reserved by a different initiator or when an element involved in the requested diagnostic is reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB or the parameter list.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- The autoloader is not ready because the cartridge access port door is open.
- A reserved bit is set to 1 in the CDB.
- The autoloader encounters a hardware problem while trying to perform the requested test.
- A parameter in the CDB or Send Diagnostic Parameter List is invalid (see Table 22-2 for sense data).

Table 22-2 *Invalid parameters in the SEND DIAGNOSTIC CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	1Ah	00h	1	1	0	0	0003h	Invalid Parameter List Length.
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.

Table 22-2 *Invalid parameters in the SEND DIAGNOSTIC CDB*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	4	0001h	Invalid Page Format field.
5h	24h	00h	1	1	1	1	0001h	Invalid value in DevOfl field.
5h	24h	00h	1	1	1	0	0001h	Invalid value in UnitOfl field.
5h	26h	00h	1	0	0	0	0000h	Invalid Page Code.
5h	26h	00h	1	0	0	0	0001h	Invalid Reserved byte in the Parameter List.
5h	26h	00h	1	0	0	0	0002h	Invalid Page Length.
5h	26h	02h	1	0	0	0	0004h	Invalid Test Parameter.
5h	26h	02h	1	0	0	0	0005h	Invalid Test Count.
5h	3Bh	0Eh	0	0	0	0	0000h	Source location for move is empty.
5h	53h	02h	0	0	0	0	0000h	Media removal is prevented. The requested test cannot be performed.
5h	80h	05h	0	0	0	0	0000h	The source tape drive does not exist.
5h	80h	06h	0	0	0	0	0000h	The destination tape drive does not exist.

23

SEND VOLUME TAG (B6h)

Bit Byte	7	6	5	4	3	2	1	0
00	1	0	1	1	0	1	1	0
01	Reserved				Element Type Code			
02	(MSB) Starting Element Address							
03	(LSB)							
04	Reserved							
05	Reserved				Send Action Code			
06	Reserved							
07								
08	(MSB) Parameter List Length							
09	(LSB)							
10	Reserved							
11	0	0	Reserved				0	0

23.1 About This Command

The SEND VOLUME TAG command requests that the autoloader scan the bar code labels affixed to the cartridges and compare this volume tag information with a template sent as part of a parameter list to this command. To obtain the results of the scan performed by this command, use the REQUEST VOLUME ELEMENT ADDRESS (B5h) command.

Notes: Refer to Table 23-1 for a description of each of these errors.

- In a multi-initiator environment, you should reserve the entire autoloader using the RESERVE (16h or 56h) command before you use the SEND VOLUME TAG command. Do not issue the RELEASE (17h or 57h) command until after you have successfully obtained data with the REQUEST VOLUME ELEMENT ADDRESS command. You should issue the commands in the following order:

  1. RESERVE (16h) for the entire autoloader
  2. SEND VOLUME TAG (B6h)
  3. REQUEST VOLUME ELEMENT ADDRESS (B5h)
  4. RELEASE (17h)

- The autoloader supports only the volume tag information scanned on the bar code label on the cartridges.

- The autoloader does not allow the modification of volume tag information once it has been read from the bar code label.

- The autoloader will not match the label of a cartridge with the Volume Identification Template Field in the Send Volume Tag Parameter List if any of the following errors occur while it is scanning the cartridge:

- Cannot read bar code label

- Tape drive not installed

- No bar code label

23.2 WHAT YOU SEND TO THE AUTOLOADER

Element Type Code – Byte 01, Bits 3 through 0

This field defines the elements to be scanned for a match to the template contained in the parameter list, as follows:

0h – All Element Types
1h – Medium Transport Element (cartridge loader)
2h – Storage Element (cartridge cells)
4h – Data Transfer Element (tape drive)

For an Element Type Code of 0h, the element types are reported in element address order, beginning with the Starting Element Address.

Note: If you specify element type code 3h, the autoloader returns Good status and an Element Status header with all fields set to 00h.

Starting Element Address – Byte 02 and 03

This field specifies the minimum element address at which to start the search for volume tag information that matches the template in the parameter list (see page 23-3). Only elements with addresses greater than or equal to the Starting Element Address are searched.

Note: The Starting Element Address must be 0 or a valid element address for the autoloader, but does not have to be an address of the type requested in the Element Type Code. Only the elements of the requested element type are searched.

Send Action Code – Byte 05, Bits 4 through 0

This field defines the specific function to be performed by this command. The autoloader supports a Send Action Code of 5h (translate, search all primary volume tags, and ignore sequence numbers).

Parameter List Length – Bytes 07 through 09

This field specifies the length of the parameter list following this command. The minimum length of the parameter list is 32 bytes (20h). The maximum length is 40 bytes (28h).

23.2.1 SEND VOLUME TAG PARAMETER LIST

Bit Byte	7	6	5	4	3	2	1	0
00 ... 31	Volume Identification Template Field							
32 ... 39	Reserved							

Volume Identification Template Field – Bytes 00 through 31

This field contains 32 bytes of volume identification information, which the autoloader compares to the volume tag (bar code) information stored in nonvolatile memory. Only the first eight bytes are valid. Any additional bytes must be 0 (null). The template is considered terminated after the first 0 byte is detected. This field may contain the following characters:

? (3Fh) – This character matches any single character at that position within the field.

* (2Ah) – This character is a wild card that matches any characters from that point on in that field. All characters past the "*" in the field are ignored.

Examples of valid templates are as follows:

Template	Matches
123?5678	12305678 12315678 and so on
123*5678	123___ (Any information starting with "123"; 5678 is ignored)

23.3 COMMAND STATUS

The autoloader returns a status byte after processing the SEND VOLUME TAG command. This section describes when each type of status byte might be returned.

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB or the volume tag data.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- The autoloader is not ready because the door is open.
- A reserved bit is set to 1 in the CDB or parameter list.

- A parameter in the CDB or parameter list is invalid (see Table 23-1 for sense data).

Table 23-1 *Invalid parameters in the SEND VOLUME TAG CDB and parameter list*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	1Ah	00h	1	1	0	0	0008h	Invalid Parameter List Length.
5h	21h	01h	1	1	0	0	0002h	Invalid Starting Element Address.
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.
5h	24h	00h	1	1	1	3	0001h	Invalid Element Type Code.
5h	24h	00h	1	1	1	4	0005h	Invalid Send Action Code.
5h	26h	00h	1	0	0	0	—[a]	Invalid reserved field in parameter list.

[a] The field pointer is set to the first reserved field in the parameter list that contains a non-zero value (that is, 8, 9, 10, . . . , 38, 39).

Notes

24

TEST UNIT READY (00h)

Bit Byte	7	6	5	4	3	2	1	0
00	0	0	0	0	0	0	0	0
01	Reserved							
02								
03								
04								
05	0	0	Reserved				0	0

24.1 About This Command

The TEST UNIT READY command allows the initiator to determine if the autoloader is ready to accept all other valid commands, including motion commands. This is not a request for a autoloader self-test, which occurs at power-on. If the autoloader is ready to accept any valid command without returning Check Condition, Reservation Conflict, or Busy status, this command returns Good status.

Note: The autoloader does not check to see if a different initiator has any elements reserved. If an element is reserved by a different initiator, the autoloader returns Reservation Conflict status for the next command after the TEST UNIT READY command.

24.2 Command Status

The autoloader returns a status byte after processing the TEST UNIT READY command. This section describes when each type of status byte might be returned.

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when it is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status when it is reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurs while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB.
- The command is issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.
- The autoloader has experienced an unrecoverable hardware error.
- The autoloader is not ready because the door is open.
- A reserved bit is set to 1 in the CDB.
- A parameter in the CDB or parameter list is invalid (see Table 24-1 for sense data).

Table 24-1 *Invalid parameters in the TEST UNIT READY CDB and parameter list*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
5h	24h	00h	1	1	1	—	—	A reserved bit is set in the CDB. The pointers point to the bit in error.

25

WRITE BUFFER (3Bh)

Bit / Byte	7	6	5	4	3	2	1	0
00	0	0	1	1	1	0	1	1
01	Reserved					Mode		
02	Buffer ID							
03	(MSB)							
04	Buffer Offset							
05								(LSB)
06	(MSB)							
07	Parameter List Length							
08								(LSB)
09	WBF	0	Reserved				0	0

25.1 About This Command

The BUFFER WRITE allows you to load new microcode (also known as firmware) across the SCSI bus into the autoloader's flash EEPROM. The autoloader processes this command when it is executing the flash EEPROM code or when it is executing the ROM boot code.

Note: If new microcode becomes available, you can obtain a copy (in machine-readable form) from your vendor or download it from Exabyte's web site (www.exabyte.com).

If the initiator has less than 131,072 (020000h) bytes of buffer space available, you may want to issue more than one WRITE BUFFER command to transfer each section of the microcode.

Be sure to heed the following cautions when issuing the WRITE BUFFER command to update the microcode stored in the autoloader's flash EEPROM.

Caution

- The WRITE BUFFER command allows you to load new microcode over the SCSI bus into the autoloader's flash EEPROM. It is not intended to be used for testing autoloader functionality (that is, do not issue this command unless you are actually loading new microcode).
- Because of memory limitations, the autoloader cannot validate the new microcode data before erasing and reprogramming the flash EEPROM. If the checksum calculated by the autoloader does not match the embedded checksum, the autoloader continues executing from the Boot Block code. As a result, you will only be able to issue a limited number of SCSI commands successfully: REQUEST SENSE, INQUIRY, READ BUFFER, and WRITE BUFFER.
- Do not load microcode from one model of autoloader into another. (For example, do not load microcode from an VXA-2 1x10 PacketLoader 1U into the Magnum 1x7 LTO Autoloader or vice versa.)
- Be sure that the autoloader is reserved for the initiator's exclusive use while the WRITE BUFFER command is executing.
- Do not power off or reset the autoloader while this command is executing.

When the WRITE BUFFER command is used to update the microcode, the following actions occur:

1. If this was not the last or only WRITE BUFFER command, the autoloader writes the microcode data to the buffer, returns Good status, and goes to the Bus Free phase. Then, it waits for the next WRITE BUFFER command. Otherwise, it goes to step 4.
2. When the autoloader receives the next WRITE BUFFER command, it repeats steps 1 and 2.
3. When the data from the last or only WRITE BUFFER command has been transferred, the autoloader disconnects from the SCSI bus.
4. The flash EEPROM is erased and reprogrammed with the new microcode. After the flash EEPROM is programmed with new microcode, part of the nonvolatile memory is erased. Because the cartridge inventory is stored in this nonvolatile memory it is erased during the reprogramming process.
5. The autoloader reconnects to the SCSI bus and returns Good status if the command was successful.
6. A Unit Attention condition is set for all hosts. The sense data indicates that the microcode has changed.
7. The autoloader performs its normal power-on self test and reestablishes the cartridge inventory.

25.2 WHAT YOU SEND TO THE AUTOLOADER

Mode – Byte 01, Bits 2 through 0

The Mode field determines the type of operation to be performed. The autoloader performs the following operations:

100b – Write microcode to buffer but do not save it to EEPROM
101b – Write microcode to buffer and save entire buffer to EEPROM

Buffer ID – Byte 02

This field specifies which section of EEPROM is the target for the data in the current WRITE BUFFER command. EEPROM is divided into eight sections, of which six are used for functional code. Valid values for this field are 02h through 07h. See Section 25.2.1 for more detailed information about the sections of the code defined by each Buffer ID value.

Buffer Offset – Bytes 03 through 05

This field specifies where in the buffer to begin writing the downloaded microcode data. Valid values for this field are from 000000h to 020000h minus the Parameter List Length value. If the sum of the Buffer Offset and the Parameter List Length is greater than 020000h (131,072) bytes, the autoloader returns CHECK CONDITION status.

Parameter List Length – Bytes 06 through 08

The Parameter List Length field specifies the number of bytes to be transferred by the current WRITE BUFFER command. Valid values for this field are from 000000h to 020000h (131,072) bytes. If the sum of the Buffer Offset and the Parameter List Length is greater than 020000h (131,072) bytes, the autoloader returns CHECK CONDITION status.

25.2.1 USING WRITE BUFFER TO UPDATE THE AUTOLOADER MICROCODE

Although the autoloader's EEPROM has a capacity of 1,048,576 bytes (100000h), the autoloader buffer can only accept 131,072 bytes (20000h) of data at one time. Therefore, in order to program the entire EEPROM, the microcode must be downloaded and stored in the EEPROM in sections. Each section of the EEPROM contains 20000h bytes, as follows:

- The first 262,144 bytes (bytes 000000h through 03FFFFh) of the microcode update file correspond to the Boot Block code, which cannot be changed. These bytes should not be transferred to the autoloader. The Boot Block code is a subset of the autoloader microcode that allows the functional code to be updated even if the functional code currently stored in the autoloader has been so damaged as to make it inoperable.

  Note: If you attempt to transfer data to the section of memory that is reserved for the Boot Block code the autoloader returns Check Condition status with an ASC/ASCQ of 24h/00h (Illegal Request).

- The functional code resides in the remainder of the EEPROM (040000h through 0FFFFFh) and is divided into six equal sections each corresponding to a Buffer ID, as shown in Table 25-1.

Table 25-1 *Buffer IDs and byte locations of functional code sections*

Section	Buffer ID	Byte location
2	02h	040000h through 05FFFFh
3	03h	060000h through 7FFFFh
4	04h	08000h through 9FFFFh
5	05h	0A000h through BFFFFh
6	06h	0C0000h through DFFFFh
7	07h	0E0000h through 0FFFFFh

Each of section of the functional code must be downloaded separately to the autoloader's buffer and then programmed to the EEPROM. For example, to download section 2 (Buffer ID 02h), use the WRITE BUFFER command to send bytes 04000h through 05FFFFh of the microcode update file to bytes 000000h to 01FFFFh of the buffer. Similarly, for section 3 (Buffer ID 03h), send bytes 060000h to 07FFFFh of the microcode update file to bytes 000000h to 01FFFFh of the buffer.

You can use one or more WRITE BUFFER commands to download a section of the function code in the microcode update file to the buffer and program it into the EEPROM. For each WRITE BUFFER command you issue, make sure that you do the following:

- The sections of the functional code must be downloaded to the buffer and programmed to the EEPROM sequentially, from Buffer ID 02 to Buffer ID 07h.
- If you use multiple WRITE BUFFER commands, set the Mode bit to 100b (Write microcode to buffer but do not save it to EEPROM) for the all but the last WRITE BUFFER command in the download sequence.
- For the final WRITE BUFFER command in the download sequence or if you use only one WRITE BUFFER command to download the whole section at once, set the Mode bit to 101b (Write microcode to buffer and save entire buffer to EEPROM).
- Use the Buffer ID to specify the section of microcode being downloaded.
- When using multiple WRITE BUFFER commands to download a section of the microcode, use the Buffer Offset to specify the location in the buffer to write the data. Usually the Buffer Offset is the sum of all the Parameter List Lengths used in the sequence of WRITE BUFFER command used to transfer to the section of microcode.

  When using a single WRITE BUFFER command to download an entire section of the microcode, set the Offset Buffer to 00h.

- The Parameter List Length for each WRITE BUFFER command must be evenly divisible by 80h (128).

When all 131,072 bytes of the specified section have been downloaded to the buffer, the autoloader disconnects from the SCSI bus and begins executing the Boot Block code to program the selected EEPROM section. If the section programmed was not section 7 (that is, the Mode bit was not set to 101b), the autoloader will remain in Boot Block mode. It will reconnect to the host, send Good status, and await additional WRITE BUFFER commands to program remaining sections.

After the data for section 7 (Buffer ID 07h) has been downloaded and programmed into the EEPROM, the autoloader will attempt a normal functional boot. The autoloader will verify the checksum of the functional code, and, if it is correct, begin to execute the functional code. The autoloader will reconnect to the host, send Good status, and become ready for normal operations.

25.3 COMMAND STATUS

The autoloader returns a status byte after processing the WRITE BUFFER command. This section describes when each type of status byte might be returned.

Good

The autoloader returns Good status when it is able to process the command without errors.

Busy

The autoloader returns Busy status when it is processing a command for a different initiator or when the autoloader is in the process of aborting a motion command.

Reservation Conflict

The autoloader returns Reservation Conflict status when it is reserved or any of its elements are reserved by a different initiator. See Chapter 20 for more information about the RESERVE command.

Check Condition

The autoloader returns Check Condition status for the following reasons:

- The message system is enabled and a message error occurred while the autoloader is processing the command.
- The autoloader detects an unrecoverable parity error while receiving the CDB or microcode.
- The command was issued to an invalid LUN.
- A Unit Attention condition is pending for the initiator.

- The autoloader is unable to erase the flash EEPROM.
- The autoloader is unable to program the flash EEPROM.
- The flash code checksum is not valid after the flash EEPROM is programmed with the new microcode.
- A Console write microcode or read microcode operation is already in progress when the WRITE BUFFER command is received.
- A reserved bit was set to 1 in the CDB.
- A parameter in the CDB is invalid (see Table 25-2 for sense data).

Table 25-2 *Invalid parameters in the WRITE BUFFER CDB and errors in programming the flash EEPROM*

Sense Key	ASC	ASCQ	SKSV Bit	C/D Bit	BPV Bit	Bit Pointer	Field Pointer	Error
4h	3Fh	80h	0	0	0	0	0000h	Flash code microcode write error: unable to erase flash EEPROM.
4h	3Fh	82h	0	0	0	0	0000h	Flash code microcode write error: unable to write zeros to flash EEPROM.
4h	3Fh	84h	0	0	0	0	0000h	Flash code microcode write error: unable to program flash EEPROM.
4h	3Fh	86h	0	0	0	0	0000h	Flash code microcode write error: bad flash code checksum.
5h	1Ah	00h	1	1	0	0	0006h	Invalid Parameter List Length.
5h	24h	00h	1	1	0	0	0001h	Invalid Mode value.
5h	24h	00h	1	1	0	0	0002h	Invalid Buffer ID value.
5h	24h	00h	1	1	0	0	0006h	Invalid Combination of Buffer Offset and Parameter List Length.

A

Error Codes

This appendix describes the errors reported by the autoloader. The autoloader uses two methods for reporting error conditions:

- Errors that occur only when the autoloader is being operated from the operator panel or in Sequential mode, or when the autoloader is performing diagnostics, only appear on the LCD and are not reported by the REQUEST SENSE command.
- If the autoloader is operating in Random mode, errors are reported over the SCSI bus. Some of these errors also appear on the LCD, others do not. Section A.2 on page A-6 describes errors reported over the SCSI bus are associated with the sense key data returned by the library in response to a REQUEST SENSE command (see Chapter 18).

A.1 Error Messages Displayed on the LCD

This section describes the error messages that can appear on the autoloader's operator panel and provides corrective actions. If an LCD error has a Sense Key value of 4h (Hardware Error) or 5h (Illegal Request) it is also reported over the SCSI bus in response to a REQUEST SENSE command.

Caution Most autoloader components can be replaced only by Exabyte-approved service providers. If you cannot find an obvious cause for the problem, contact your service provider. Do not attempt to replace any components other than the tape drive. If you do, you will void your warranty.

! Important Some corrective actions advise you to reset or power the autoloader off and back on. To avoid disrupting communication between the host computer and other devices on the bus, make sure that there is no activity on the bus before you reset or power off the autoloader. If you need to power the autoloader off, first unload the cartridge from the tape drive, if possible, to avoid possible damage to the cartridge.

Table A-1 lists autoloader error messages in alphabetical order. If the suggested corrective action does not correct the error, contact Exabyte Technical Support (see page iii) or your service provider.

Table A-1 *Autoloader error messages*

Error Message	Description	Corrective Action
Autoloader is Busy	The autoloader is executing a command issued from the application when a command is issued from the operator panel.	Wait until the autoloader has finished its current operation, then retry the requested operation.
Bootblock	An error occurred during a firmware upload to the autoloader.	1. Verify that you loaded the correct code. Do not load firmware from one model of autoloader or autoloader into another. 2. Reset the autoloader and reload the firmware. See Section 3.2 on page 3-2 for reset instructions. 3. If the error persists, contact your service provider.
Cartridg.Invalid	An attempt was made to load an incompatible cartridge into the tape drive or a spent cleaning cartridge and the cartridge was ejected.	▪ Remove the cartridge from the autoloader and replace it with one that is compatible with the tape drive. ▪ If you were attempting to import a cleaning cartridge, insert a cartridge with cleaning cycles remaining on it.
Command Failed Check Ship Lock	The cartridge loader could not move because it may be locked in place by the shipping key.	Make sure that the shipping key that was in the slot in the top cover of the autoloader has been removed.
Command Failed Drive is Full	A command was issued from the operator panel to load a cartridge into the tape drive when the drive already contained a cartridge.	Wait until the current cartridge is unloaded by the application, or use the operator panel to unload it from the tape drive. Refer to the *Magnum 1x7 LTO Autoloader Product Manual* for instructions.
Command Rejected Carousel Full	A command was issued from the operator panel to insert a cartridge into the autoloader when all of the cartridge cells were already full.	Export a cartridge from the autoloader to make room for a new cartridge. Refer to the *Magnum 1x7 LTO Autoloader Product Manual* for instructions.
Command Rejected Empty Carousel	A command was issued from the operator panel to either load a cartridge into the tape drive or remove a cartridge from the autoloader when there were no cartridges in the cartridge carousel.	Wait until the cartridge is ejected from the tape drive, or use the operator panel to import cartridges into the autoloader. Refer to the *Magnum 1x7 LTO Autoloader Product Manual* for instructions.

Table A-1 *Autoloader error messages (continued)*

Error Message	Description	Corrective Action
Configuration Locked by Host	The application is currently controlling the autoloader (a SCSI command is active) or the Remote Management utility is controlling the autoloader.	Wait for the command from the application to complete.
Device Not Ready	The autoloader is not ready to perform the requested operation because it is performing diagnostics or its power-on self-test (POST).	Wait until the autoloader has finished, then retry the operation.
Drive CMD Error	The tape drive received an invalid command.	1. If possible, use the operator panel to unloaded any cartridge that is in the tape drive. Refer to the *Magnum 1x7 LTO Autoloader Product Manual* for instructions on unloading a cartridge from the tape drive. 2. Power the autoloader off and back on to reset the tape drive. 3. If the error persists, contact your service provider.
Drive Load Fail	The cartridge couldn't be loaded into the tape drive because of a mechanical problem or because of a broken tape.	1. Export the tape from the autoloader and verify that it is in good condition, then retry the operation.Refer to the *Magnum 1x7 LTO Autoloader Product Manual* for instructions on exporting cartridges from the autoloader. 2. If the error persists, contact your service provider
Drive Timeout	The tape drive took too long to load or unload a tape, or the tape drive is not responding.	1. If possible, use the operator panel to unloaded any cartridge that is in the tape drive. Refer to the *Magnum 1x7 LTO Autoloader Product Manual* for instructions on unloading a cartridge from the tape drive. 2. Power the autoloader off and back on to reset the tape drive. 3. If the error persists, contact your service provider.
Drv Unload Fail	The cartridge couldn't be unloaded from the tape drive because of a mechanical problem.	1. Power the autoloader off and back on to reset the tape drive. 2. Retry the unload operation once. 3. If the error persists, contact your service provider.

Table A-1 *Autoloader error messages (continued)*

Error Message	Description	Corrective Action
H/W Inoperable	An operation couldn't be completed because of a mechanical problem.	1. Reset the autoloader and retry the operation.See Section 3.2 on page 3-2 for reset instructions. 2. If the error persists, contact your service provider.
Hardware Error	An operation couldn't be completed because of a mechanical problem.	1. Reset the autoloader and retry the operation.See Section 3.2 on page 3-2 for reset instructions. 2. If the error persists, contact your service provider.
In Enet Mode	The autoloader is executing a command issued from the Remote Management utility when a command is issued from the operator panel.	Wait until the autoloader has finished its current operation, then retry the operation.
In Security Mode Choice Rejected	Autoloader security has been set from the application.	Disable autoloader security from the application and retry the operation.
Media Removal is Locked by Host	Media removal from the autoloader has been prevented through the application.	Turn off media removal prevention from the application and retry the operation.
Over Temperature	The tape drive's temperature limit has been exceeded, and the cartridge has been ejected from the drive.	▪ Wait until the autoloader has cooled, then unload the cartridge to a cell and re-load it into the tape drive. ▪ Check the room temperature. The ambient temperature must be no more than 40°C (104°F). ▪ Provide additional air flow around the autoloader to improve cooling.
POST Failed	The autoloader encountered an error during its power-on self-test.	Reset the autoloader. See Section 3.2 on page 3-2 for reset instructions.
Sequential Mode	An application tried to issue commands to the autoloader while it was set to Sequential mode.	Set the autoloader to Random mode. (Refer to the *Magnum 1x7 LTO Autoloader Product Manual* for information about the autoloader control modes.)
Servo Error	The autoloader carousel has experienced a problem.	1. Reset the autoloader and retry the operation.See Section 3.2 on page 3-2 for reset instructions. 2. If the error persists, contact your service provider

Table A-1 *Autoloader error messages (continued)*

Error Message	Description	Corrective Action
Servo Jammed	The autoloader carousel has experienced a problem.	1. Reset the autoloader and retry the operation.See Section 3.2 on page 3-2 for reset instructions. 2. If the error persists, contact your service provider
Servo Timeout	The autoloader carousel has experienced a problem.	1. Reset the autoloader and retry the operation.See Section 3.2 on page 3-2 for reset instructions. 2. If the error persists, contact your service provider.
System Error	The autoloader has experienced a fatal error.	1. Reset the autoloader and retry the operation.See Section 3.2 on page 3-2 for reset instructions. 2. If the error persists, contact your service provider.
System Timeout	An autoloader operation took too long.	1. Reset the autoloader and retry the operation.See Section 3.2 on page 3-2 for reset instructions. 2. If the error persists, contact your service provider.
Tape Alert Halt	The autoloader has experienced a Tape Alert event. For example: ▪ A tape drive component has exceeded its expected operational lifetime. ▪ TapeAlert asynchronous notification. ▪ TapeAlert asynchronous notification test	1. Reset the autoloader and retry the operation.See Section 3.2 on page 3-2 for reset instructions. 2. If the error persists, contact your service provider.
Tape incorrectly inserted. RETRY	A tape was inserted through the cartridge access port in the wrong orientation.	Position the cartridge with the hub down and the side with the bar code label and write-protect switch towards the door and re-insert it. Do not insert cartridges with the label and write-protect switch toward you. The arrow on the cartridge must face toward the outside.
Wait for Command To Complete	The autoloader is executing a command issued from the application or the Remote Management utility when a command is issued from the operator panel.	Wait until the autoloader has finished its current operation, then retry the operation.

A.2 ERRORS REPORTED OVER THE SCSI BUS

If the autoloader is operating in Random mode, errors are reported over the SCSI bus. Some of these errors also appear on the LCD, others do not. Errors reported over the SCSI bus are associated with the sense key data returned by the autoloader in response to a REQUEST SENSE command (see Chapter 18). These error codes include the following error information:

- The sense key (SK), Additional Sense Codes (ASCs), and Additional Sense Code Qualifiers (ASCQs) associated with the error. The ASC and ASCQ codes provide additional information for each sense key. See Table 18-1 on page 18-3 for definitions of the sense keys.
- The Exabyte-unique Fault Symptom Codes (FSCs). These codes can be used to determine the nature of hardware and software errors and other events. The Fault Symptom Codes are defined on page 8-15.

This section lists the possible combinations of values for the Additional Sense Code (ASC) and the Additional Sense Code Qualifier (ASCQ) fields in the Extended Sense data returned by the REQUEST SENSE (03h) command. Each ASC and ASCQ combination is associated with one or more Sense Key values, and one or more FSCs.

For ease of reference, Table A-2 lists all of the possible ASC, ASCQ, Sense Key, and FSC values returned by the autoloader, sorted in ascending ASC/ASCQ order. Each combination of values is accompanied by one or more cause codes and one or more error recovery procedure codes (ERPs). Table A-3 on page A-12 lists the same information as Table A-2, but it is sorted in ascending FSC order. The ERPs are described in Section A.3 on page A-18.

Note: When two or more ERP codes are listed for a Fault Symptom Code, attempt the recovery procedures in the order listed.

Cause Key:

A =	Application software	**L =**	Autoloader
B =	Bus (SCSI)	**O =**	Operator
D =	Drive	**S =**	System
I =	Information message	**T =**	Tape

Table A-2 *REQUEST SENSE error information (ASC, ASCQ, FSC, and SK)*

ASC (byte 12)	ASCQ (byte 13)	FSC	Sense Key	Cause	ERP	SCSI Error Message and Description
00h	00h	00h	0h	I	10	**No error.**
00h	06h	04h	Bh	O, B, D, A, S	11	**IO Process terminated.** SCSI data transfer aborted.
04h	01h	12h	02h	O, B, A, S	11	**Logical Unit becoming ready.**The autoloader is not ready, but is in process of becoming ready.
04h	83h	12h	02h	O	11, 1	**Not Ready. Door open**. The cartridge access port door is open.
04h	89h	22h	02h	O	11, 2	**Not Ready. Console mode**. An application tried to issue commands to the autoloader while it was being controlled from the Remote Management utility.
04h	8Dh	21h	02h	O	11, 2	**Not Ready. Key mode**. An application tried to issue commands to the autoloader while it was being controlled from the operator panel.
04h	8Eh	1Eh	02h	O	11, 2	**Not Ready. Sequential mode.** An application tried to issue commands to the autoloader while it was in Sequential mode.
15h	81h	09h	4h	T, L, D	8, 14, 12,13	**Pick failure.** The cartridge loader could not pick a cartridge because of mechanical problems.
15h	83h	09h	4h	T, L, D	8, 14, 12,13	**Put failure.** The cartridge loader could not place a cartridge because of mechanical problems.
1Ah	00h	10h	5h	A	4	**Parameter length error.** The parameter list length was not valid. This error is a result of any of the following: ▪ Parameter List Length error in the MODE SELECT CDB. ▪ Illegal transfer length in CDB.
20h	00h	10h	5h	A	4	**Invalid Command OP code.** The operation code (OP code) for the CDB was invalid.
21h	01h	10h	5h	A, O	4	**Invalid element address.** There was an invalid element address specified in the CDB.

Table A-2 *REQUEST SENSE error information (ASC, ASCQ, FSC, and SK) (continued)*

ASC (byte 12)	ASCQ (byte 13)	FSC	Sense Key	Cause	ERP	SCSI Error Message and Description
24h	00h	10h	5h	A	4	**Invalid field in CDB.** There were invalid fields in the CDB.
25h	00h	10h	5h	A, O	4	**Logical Unit not supported.** The logical unit number specified in the Identify message or in the CDB is not zero.
26h	00h	10h	5h	A, O	4	**Invalid field in parameter list.** There was an invalid field in the parameter list.
26h	02h	10h	5h	A, O	4, 15	**Parameter value invalid.** There was an invalid parameter value in the parameter list.
28h	00h	00h	6h	I	10, 11	**Not Ready to Ready. Door closed.** The autoloader's door was opened and then closed.
29h	00h	00h	6h	I	10, 11	**Power on or reset.** A power-on, SCSI bus reset, or Target Reset message occurred.
2Ah	01h	00h	6h	I	10, 11	**Mode parameters changed.** Mode parameters have been changed. Issue a MODE SENSE (1Ah) command to determine what the new mode parameters are.
2Ah	02h	00h	6h	I	10, 11	**Log parameters changed.** Log parameters have been changed. Issue a LOG SENSE (4Dh) command to determine what the new log parameters are.
30h	00h	16h, 1Fh	3h	T, D	9, 14, 13, 12	**Incompatible medium.** (The media does not have a compatible logical format.) ▪ Incompatible media was ejected after a LOAD command was issued. ▪ Incompatible media was rejected after the data cartridge was inserted.
3Bh	0Dh	18h, 1Ch	5h	A, O	11, 6	**Destination full.** The destination element was occupied for a MOVE MEDIUM command. Redirect the cartridge loader to a different location.
3Bh	0Eh	19h, 1Dh	5h	A, O	11, 7	**Source empty.** The source element was empty for a MOVE MEDIUM command. Redirect the cartridge loader to a different location.

Table A-2 *REQUEST SENSE error information (ASC, ASCQ, FSC, and SK) (continued)*

ASC (byte 12)	ASCQ (byte 13)	FSC	Sense Key	Cause	ERP	SCSI Error Message and Description
3Fh	00h	13h	6h	S, O	11	**Operating condition changed. Over temperature.** The autoloader's internal temperature is at a unsafe level for the media. ▪ Wait until the autoloader has cooled, then unload the cartridge to a cell and re-load it into the tape drive. ▪ Check the room temperature. The ambient temperature must be no more than 40°C (104°F). ▪ Provide additional air flow around the autoloader to improve cooling.
3Fh	01h	00h	6h	I	10	**Microcode changed.** New microcode was loaded.
3Fh	03h	00h	6h	I	10	**Inquiry data has changed.** Data in the Standard Inquiry Page has been altered. Issue an INQUIRY (12h) command to determine what the new Inquiry Data. Compare the Standard Inquiry Data Page to the The Original Data Page (Page Code C0h) to determine what changed. **Note:** Changes to the Standard Inquiry data may make it necessary to reload drivers.
3Fh	86h	15h	4h	L	8, 15, 12	**Checksum miscompare.** The flash EEPROM checksum was bad.
44h	00h	05h, 06h, 07h	4h	T, L, D	8, 13, 12	**Internal target fail.** (Software error.) Firmware consistency failure.
45h	00h	08h	Bh	B, L, D, S	8, 11, 12, 13	**Select/Reselect fail.** A SCSI selection or reselection failed. The host rejected the Identify message sent by the autoloader after the autoloader reselected the host.
47h	00h	08h	Bh	B, L, D, S	8, 17, 11, 12, 13	**SCSI parity error.** The command was aborted because of a SCSI bus parity error.

Table A-2 *REQUEST SENSE error information (ASC, ASCQ, FSC, and SK) (continued)*

ASC (byte 12)	ASCQ (byte 13)	FSC	Sense Key	Cause	ERP	SCSI Error Message and Description
48h	00h	08h	Bh	B, L, D, S	8, 17, 11, 12, 13	**Initiator detected error.** Operation aborted. Either the message system was disabled and the autoloader discovered a parity error on the SCSI bus, or the message system was enabled and the initiator rejected a Restore Data Pointers message that the autoloader sent to recover from a parity error. Or, all parity error retries were exhausted.
4Ah	00h	08h	Bh	B, L, D, S	8, 17, 11, 12, 13	**Command phase error.** A SCSI phase error occurred during the command phase.
4Bh	00h	08h	Bh	B, L, D, S	8, 17, 11, 12, 13	**Data phase error.** A SCSI phase error occurred during the data phase.
4C	00	05h	02h	L, D	8, 11, 12, 13	**Logical unit failed self config.** The bootblock code is active and normal functional code cannot be started.
4Eh	00h	02h	Bh	B, L, D, S, A	8, 11, 12, 13	**Overlapped commands attempt.** Overlapped commands attempted. Bad initiator-target-LUN (ITL) nexus.
53h	00h	1Fh, 20h	03h	I	10	**Media Load/Eject fail.** Media removal prevented.
53h	02h	17h	5h	O, S, A	5, 8	**Media removal not allowed.** The autoloader cartridge access port door cannot be opened because the operation was prevented with a PREVENT/ALLOW MEDIUM REMOVAL command.
5Bh	01h	00h	6h	I	11	**Threshold condition met.** Log threshold met. (For additional information about this error, look at the Log Parameter Page Code and Log Parameter Code bytes in the REQUEST SENSE data.)
5Bh	02h	00h	1h	I	11	**Log counter at max.** Log parameter overflow. (A cumulative counter reached its maximum value of all FFs.)

Table A-2 *REQUEST SENSE error information (ASC, ASCQ, FSC, and SK) (continued)*

ASC (byte 12)	ASCQ (byte 13)	FSC	Sense Key	Cause	ERP	SCSI Error Message and Description
5D	FFh	00h	6h	T, L, D	11	**TapeAlert exception.** This error is a result of any of the following: ▪ An autoloader component has exceeded its expected operational lifetime. ▪ TapeAlert asynchronous notification. ▪ TapeAlert asynchronous notification test.
83h	00h	—		T, L	14, 16, 12	**Bad label. Questionable.**The bar code label is questionable. Issue an INITIALIZE ELEMENT STATUS (07h or E7h) command to reread the label.
83h	01h	—		T, L	14, 16, 12	**Bad Label. Unreadable.** Cannot read bar code label.
83h	03h	—		T, L	14, 16, 12	**Bad Label. Full Question.** Label and full status questionable. The autoloader was powered on or the cartridge access port door was opened. The cartridge inventory may have been violated. Issue an INITIALIZE ELEMENT STATUS (07h or E7h) command to reestablish the cartridge inventory.
83h	09h	—		O, T	10, 16, 12	**Bad Label. No Label.** The bar code scanner could not read the bar code label because there was no label on the cartridge or the label was unreadable.
83h	0Ah	—		L	12	**Bad Label. Hardware Error.** The autoloader is unable to read the bar code label due to a bar code reader hardware error.
87h	21h	1Bh	4h	D, L	8, 13, 12	**Drive comm failed.** The autoloader is unable to communicate with the tape drive.
87h	23h	1Bh	4h	D, L	8, 13, 12	**Drive comm timeout.** The autoloader is unable to communicate with the tape drive.
87h	24h	1Bh	4h	D, L	8, 13, 12	**Drive comm failed.** The autoloader is unable to communicate with the tape drive.

Table A-2 *REQUEST SENSE error information (ASC, ASCQ, FSC, and SK) (continued)*

ASC (byte 12)	ASCQ (byte 13)	FSC	Sense Key	Cause	ERP	SCSI Error Message and Description
87h	25h	12h	4h	I	8, 13, 12	**Drive not ready.** The tape drive did not return Ready status after a reset.
87h	26h	1Ah	4h	D, L	8, 13, 12	**Drive command error.** The tape drive failed to respond to a command from the autoloader.

Table A-3 lists the same information as Table A-2, but it is sorted in ascending FSC order.

Table A-3 *REQUEST SENSE error information (FSC, ASC, ASCQ, and SK*

FSC	ASC (byte 12)	ASCQ (byte 13)	Sense Key	Cause	ERP	SCSI Error Message and Description
—	83h	00h		T, L	14, 16, 12	**Bad label. Questionable.**The bar code label is questionable. Issue an INITIALIZE ELEMENT STATUS (07h or E7h) command to reread the label.
—	83h	01h		T, L	14, 16, 12	**Bad Label. Unreadable.** Cannot read bar code label.
—	83h	03h		T, L	14, 16, 12	**Bad Label. Full Question.** Label and full status questionable. The autoloader was powered on or the cartridge access port door was opened. The cartridge inventory may have been violated. Issue an INITIALIZE ELEMENT STATUS (07h or E7h) command to reestablish the cartridge inventory.
—	83h	09h		O, T	10, 16, 12	**Bad Label. No Label.** The bar code scanner could not read the bar code label because there was no label on the cartridge or the label was unreadable.
—	83h	0Ah		L	12	**Bad Label. Hardware Error.** The autoloader is unable to read the bar code label due to a bar code reader hardware error.
00h	00h	00h	0h	I	10	**No error.**
00h	28h	00h	6h	I	10, 11	**Not Ready to Ready. Door closed.** The autoloader's door was opened and then closed.
00h	29h	00h	6h	I	10, 11	**Power on or reset.** A power-on, SCSI bus reset, or Target Reset message occurred.

Table A-3 *REQUEST SENSE error information (FSC, ASC, ASCQ, and SK (continued)*

FSC	ASC (byte 12)	ASCQ (byte 13)	Sense Key	Cause	ERP	SCSI Error Message and Description
00h	2Ah	01h	6h	I	10, 11	**Mode parameters changed.** Mode parameters have been changed. Issue a MODE SENSE (1Ah) command to determine what the new mode parameters are.
00h	2Ah	02h	6h	I	10, 11	**Log parameters changed.** Log parameters have been changed. Issue a LOG SENSE (4Dh) command to determine what the new log parameters are.
00h	3Fh	01h	6h	I	10	**Microcode changed.** New microcode was loaded.
00h	3Fh	03h	6h	I	10	**Inquiry data has changed.** Data in the Standard Inquiry Page has been altered. Issue an INQUIRY (12h) command to determine what the new Inquiry Data. Compare the Standard Inquiry Data Page to the The Original Data Page (Page Code C0h) to determine what changed. **Note:** Changes to the Standard Inquiry data may make it necessary to reload drivers.
00h	5Bh	01h	6h	I	11	**Threshold condition met.** Log threshold met. (For additional information about this error, look at the Log Parameter Page Code and Log Parameter Code bytes in the REQUEST SENSE data.)
00h	5Bh	02h	1h	I	11	**Log counter at max.** Log parameter overflow. (A cumulative counter reached its maximum value of all FFs.)
00h	5D	FFh	6h	T, L, D	11	**TapeAlert exception.** This error is a result of any of the following: ▪ An autoloader component has exceeded its expected operational lifetime. ▪ TapeAlert asynchronous notification. ▪ TapeAlert asynchronous notification test.
02h	4Eh	00h	Bh	B, L, D, S, A	8, 11, 12, 13	**Overlapped commands attempt.** Overlapped commands attempted. Bad initiator-target-LUN (ITL) nexus.

Table A-3 *REQUEST SENSE error information (FSC, ASC, ASCQ, and SK (continued)*

FSC	ASC (byte 12)	ASCQ (byte 13)	Sense Key	Cause	ERP	SCSI Error Message and Description
04h	00h	06h	Bh	O, B, D, A, S	11	**IO Process terminated.** SCSI data transfer aborted.
05h	44h	00h	4h	T, L, D	8, 13, 12	**Internal target fail.** (Software error.) Firmware consistency failure.
05h	4C	00	02h	L, D	8, 11, 12, 13	**Logical unit failed self config.** The bootblock code is active and normal functional code cannot be started.
06h	44h	00h	4h	T, L, D	8, 13, 12	**Internal target fail.** (Software error.) Firmware consistency failure.
07h	44h	00h	4h	T, L, D	8, 13, 12	**Internal target fail.** (Software error.) Firmware consistency failure.
08h	45h	00h	Bh	B, L, D, S	8, 11, 12, 13	**Select/Reselect fail.** A SCSI selection or reselection failed. The host rejected the Identify message sent by the autoloader after the autoloader reselected the host.
08h	47h	00h	Bh	B, L, D, S	8, 17, 11, 12, 13	**SCSI parity error.** The command was aborted because of a SCSI bus parity error.
08h	48h	00h	Bh	B, L, D, S	8, 17, 11, 12, 13	**Initiator detected error.** Operation aborted. Either the message system was disabled and the autoloader discovered a parity error on the SCSI bus, or the message system was enabled and the initiator rejected a Restore Data Pointers message that the autoloader sent to recover from a parity error. Or, all parity error retries were exhausted.
08h	4Ah	00h	Bh	B, L, D, S	8, 17, 11, 12, 13	**Command phase error.** A SCSI phase error occurred during the command phase.
08h	4Bh	00h	Bh	B, L, D, S	8, 17, 11, 12, 13	**Data phase error.** A SCSI phase error occurred during the data phase.
09h	15h	81h	4h	T, L, D	8, 14, 12,13	**Pick failure.** The cartridge loader could not pick a cartridge because of mechanical problems.
09h	15h	83h	4h	T, L, D	8, 14, 12,13	**Put failure.** The cartridge loader could not place a cartridge because of mechanical problems.

Table A-3 *REQUEST SENSE error information (FSC, ASC, ASCQ, and SK (continued)*

FSC	ASC (byte 12)	ASCQ (byte 13)	Sense Key	Cause	ERP	SCSI Error Message and Description
10h	1Ah	00h	5h	A	4	**Parameter length error.** The parameter list length was not valid. This error is a result of any of the following: ▪ Parameter List Length error in the MODE SELECT CDB. ▪ Illegal transfer length in CDB.
10h	20h	00h	5h	A	4	**Invalid Command OP code.** The operation code (OP code) for the CDB was invalid.
10h	21h	01h	5h	A, O	4	**Invalid element address.** There was an invalid element address specified in the CDB.
10h	24h	00h	5h	A	4	**Invalid field in CDB.** There were invalid fields in the CDB.
10h	25h	00h	5h	A, O	4	**Logical Unit not supported.** The logical unit number specified in the Identify message or in the CDB is not zero.
10h	26h	00h	5h	A, O	4	**Invalid field in parameter list.** There was an invalid field in the parameter list.
10h	26h	02h	5h	A, O	4, 15	**Parameter value invalid.** There was an invalid parameter value in the parameter list.
12h	04h	01h	02h	O, B, A, S	11	**Logical Unit becoming ready.**The autoloader is not ready, but is in process of becoming ready.
12h	04h	83h	02h	O	11, 1	**Not Ready. Door open**. The cartridge access port door is open.
12h	87h	25h	4h	I	8, 13, 12	**Drive not ready.** The tape drive did not return Ready status after a reset.

Table A-3 *REQUEST SENSE error information (FSC, ASC, ASCQ, and SK (continued)*

FSC	ASC (byte 12)	ASCQ (byte 13)	Sense Key	Cause	ERP	SCSI Error Message and Description
13h	3Fh	00h	6h	S, O	11	**Operating condition changed. Over temperature.** The autoloader's internal temperature is at a unsafe level for the media. ▪ Wait until the autoloader has cooled, then unload the cartridge to a cell and re-load it into the tape drive. ▪ Check the room temperature. The ambient temperature must be no more than 40°C (104°F). ▪ Provide additional air flow around the autoloader to improve cooling.
15h	3Fh	86h	4h	L	8, 15, 12	**Checksum miscompare.** The flash EEPROM checksum was bad.
16h	30h	00h	3h	T, D	9, 14, 13, 12	**Incompatible medium.** (The media does not have a compatible logical format.) ▪ Incompatible media was ejected after a LOAD command was issued. ▪ Incompatible media was rejected after the data cartridge was inserted.
17h	53h	02h	5h	O, S, A	5, 8	**Media removal not allowed.** The autoloader cartridge access port door cannot be opened because the operation was prevented with a PREVENT/ALLOW MEDIUM REMOVAL command.
18h	3Bh	0Dh	5h	A, O	11, 6	**Destination full.** The destination element was occupied for a MOVE MEDIUM command. Redirect the cartridge loader to a different location.
19h	3Bh	0Eh	5h	A, O	11, 7	**Source empty.** The source element was empty for a MOVE MEDIUM command. Redirect the cartridge loader to a different location.
1Ah	87h	26h	4h	D, L	8, 13, 12	**Drive command error.** The tape drive failed to respond to a command from the autoloader.
1Bh	87h	21h	4h	D, L	8, 13, 12	**Drive comm failed.** The autoloader is unable to communicate with the tape drive.

Table A-3 *REQUEST SENSE error information (FSC, ASC, ASCQ, and SK (continued)*

FSC	ASC (byte 12)	ASCQ (byte 13)	Sense Key	Cause	ERP	SCSI Error Message and Description
1Bh	87h	23h	4h	D, L	8, 13, 12	**Drive comm timeout.** The autoloader is unable to communicate with the tape drive.
1Bh	87h	24h	4h	D, L	8, 13, 12	**Drive comm failed.** The autoloader is unable to communicate with the tape drive.
1Ch	3Bh	0Dh	5h	A, O	11, 6	**Destination full.** The destination element was occupied for a MOVE MEDIUM command. Redirect the cartridge loader to a different location.
1Dh	3Bh	0Eh	5h	A, O	11, 7	**Source empty.** The source element was empty for a MOVE MEDIUM command. Redirect the cartridge loader to a different location.
1Eh	04h	8Eh	02h	O	11, 2	**Not Ready. Sequential mode.** An application tried to issue commands to the autoloader while it was in Sequential mode.
1Fh	30h	00h	3h	T, D	9, 14, 13, 12	**Incompatible medium.** (The media does not have a compatible logical format.) ▪ Incompatible media was ejected after a LOAD command was issued. ▪ Incompatible media was rejected after the data cartridge was inserted.
1Fh	53h	00h	03h	I	10	**Media Load/Eject fail.** Media removal prevented.
20h	53h	00h	03h	I	10	**Media Load/Eject fail.** Media removal prevented.
21h	04h	8Dh	02h	O	11, 2	**Not Ready. Key mode**. An application tried to issue commands to the autoloader while it was being controlled from the operator panel.
22h	04h	89h	02h	O	11, 2	**Not Ready. Console mode**. An application tried to issue commands to the autoloader while it was being controlled from the Remote Management utility.

A.3 ERROR RECOVERY PROCEDURES

The following table describes the error recovery procedures (ERPs) recommended for each Fault Symptom Code listed in the previous section.

Caution Some recovery procedures advise you to reset the tape drive. Before performing a reset, make sure there is no SCSI activity on the SCSI bus to which the drive is connected. Resetting a device on an active bus may disrupt communications.

Table A-4 *Recommended error recovery procedures*

ERP	Recommended error recovery procedure
1	Press any key on the operator panel to close the door.
2	Set the autoloader to Random mode. (Refer to the *Magnum 1x7 LTO Autoloader Product Manual* for information about the autoloader control modes.)
3	Reissue the failed command or command sequence.
4	Correct the errors in the CDB bytes, parameter data, or Logical Unit Selection.
5	Issue a PREVENT/ALLOW MEDIUM REMOVAL command to allow medium removal.
6	Remove the cartridge from the destination or redirect the cartridge loader to another location.
7	Install a cartridge in the source location or redirect the cartridge loader to another location.
8	Make sure the autoloader and tape drive are not being used by any host, then perform one of the following actions to reset the autoloader: ▪ Reset the autoloader or tape drive from the operator panel (see Section 3.2 on page 3-2). ▪ Power the autoloader off and back on again. ▪ Send a SCSI bus reset (“hard” reset). If the error persists, contact your service provider.
9	Clean the tape drive and repeat the operation.
10	No action is necessary.
11	User should determine what recovery procedure to follow.
12	The autoloader requires maintenance. Contact your service provider.
13	The tape drive requires maintenance. Contact your service provider.
14	Repeat the operation with a different data cartridge.
15	Reload firmware.
16	Replace the bar code label. Refer to the *Magnum 1x7 LTO Autoloader Product Manual* for information about placing the labels on the cartridges.For specifications for the bar code labels that can be used with the autoloader, refer to the *Exabyte Bar Code Specification for LTO Ultrium Cartridges*.
17	Check the SCSI cables and terminator. Replace if damaged.

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